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High-Voltage Cables

Successful Operation of Gas-filled Type

SOME part of the debt that applied electricity owes to physics is offset by the adverse effects of the uncontrolled activities of electrons. The leading example of this contra-account is provided by the deterioration of cable dielectric under electronic bombardment, which may assume serious proportion at pressures approaching 33 kV. As a consequence the chief concern of high-voltage cable designers has been to prevent the ionisation of the air which, if permitted, occurs in pockets formed in the insulation through the expansion and contraction with load variations of cables which, for dimensional reasons, are highly stressed electrically.

British Pre-eminence

In this field British cable makers are pre-eminent, possibly because their attention was necessarily concentrated on cable problems in earlier years when the development of overhead-line technique received little encouragement in this country. In line with a great tradition is the gas-filled cable (in which nitrogen is inherently a part of the dielectric) that was described by Messrs. C. J. Beaver and E. L. Davey in the paper presented to the I.E.E. Transmission Section last week. A length of this cable has stood the test of time, operating in series with overhead lines on the 132-kV grid for more than five years; subsequent installations at from 33 kV to 132 kV seem to confirm this indication of reliability.

Incidentally, but of great importance to progress in this sphere, the value of the grid in providing opportunities for demonstrating under working conditions the feasibility of new ideas is inestimable. This feature will no doubt continue to be exploited, subject only to the overruling need to safeguard continuity of supply.

Of the various means adopted for coping with ionisation in cable dielectrics, oil filling was first off the mark (about seventeen years ago) for voltages above 33 kV, although the idea of gas-filling slightly ante-dated it. Oil, however, then appeared to be the more immediately practicable means and its success at voltages up to 220 kV (abroad) was such as to damp down interest in alternatives until recent years, when gas under pressure has been used in various forms by British cable makers to "iron out" occluded air. One such cable, which was designed to pass a foreign test of 150 kV between phases, withstood that voltage to earth for twenty-four hours.

Greater Current-carrying Capacity

As compared with the solid cable the oil- and gas-filled types possess the further advantage of giving greater current-carrying capacity for the same amount of copper and insulating material.

During the discussion that followed the reading of the I.E.E. paper the importance of certain aspects of cable design was emphasised by various speakers; these included high impulse strength (the subject of present investigations), adequate factors of safety for the dielectric and the least possible cable capacitance, the merit of

the last-named quality being likely to increase in the future. The new cable is a notable technical acquisition and the absence of associated external accessories, its reduction of fire risk and freedom from drainage on vertical runs are additional assets. No figures of comparative costs are available, but the authors' confidence on this point is pleasing, as the economic factor will, of course, be the deciding one.

Post-War Homes

BOTH the public and the electrical industry have insisted that in the hundreds of thousands of new homes which will have to be built after the war better provision must be made for the use of electricity for all purposes. A distinct step forward has been made in securing this desirable end by the Electrical Installations Committee, convened by the I.E.E. under the ægis of the Directorate of Post-War Building, whose draft first report is dealt with in this issue. The Committee considers that every domestic consumer should be regarded as a potential user of electricity for lighting, cooking, water heating and space heating and on this basis makes recommendations with regard to services and installations to ensure that the potential is translated into the actual. Convenience as well as adequacy is another essential need and the Committee takes care of this too.

Standards and Codes

THE recommendations of the Study Committees, of which the Electrical Installations Committee is one, serve at least three purposes. They constitute useful guidance to the industries concerned; they help to form a basis of good practice; and they indicate possibilities of standardisation of equipment. As regards the last two, all recommendations are received by the Standards Committee of the Directorate of Post-War Building which acts as a clearing house and also suggests to the Committees particular lines of investigation for the development of standards. The Standards Committee then transmits the recommendations to the British Standards Institution or the Codes of Practice Committee for the necessary action. Already the B.S.I. has published on behalf of the Codes of Practice Committee five War Emergency Codes of an electrical nature. We may hope to see in due course similar codes for post-war use.

What is Reinstatement?

IF a concern scheduled under an Essential Work Order is ordered to reinstate an employee who has been discharged (with permission) because there is nothing for him to do, must work be found for him? We suppose that it is always possible to create unnecessary work, but it is doubtful whether this can ever be justified; it certainly cannot be in wartime. The point came before the Court of Appeal last week, when it was sought by the Ministry of Labour to overrule a decision by local justices that the Ultra Electric Co., by paying a dismissed woman her wages, had "reinstated" her although it had not found her employment. The Court upheld the magistrates, but Mr. Justice Charles made it clear that work and wages went together and where it was possible employment should be found for the reinstated person.

New Insulation

RESEARCH in present circumstances has to be centred on finding alternatives to materials in short supply rather than on devising of technical and economic improvements as its primary object. However, one may involve the other, as Mr. A. R. Dunton was able to show, as regards insulation, in his I.E.E. Measurements Section paper. New developments in plastics, silk substitutes and enamel that is unaffected by impregnation solvents have proved especially promising fields for investigation. In many cases their qualities of resistance to moisture absorption, temperature extremes, alkalis, acids and abrasion are such as to ensure their retention in post-war practice.

"Reviews" for the Forces

OUR earlier appeals to readers who do not wish to keep their copies of the *Electrical Review* to hand them over to organisations for passing on to men in the Forces resulted in the establishment of a number of contacts. We should be pleased to hear from others who would like to participate in the scheme—both donors and war comforts committees who are in touch with Service men.

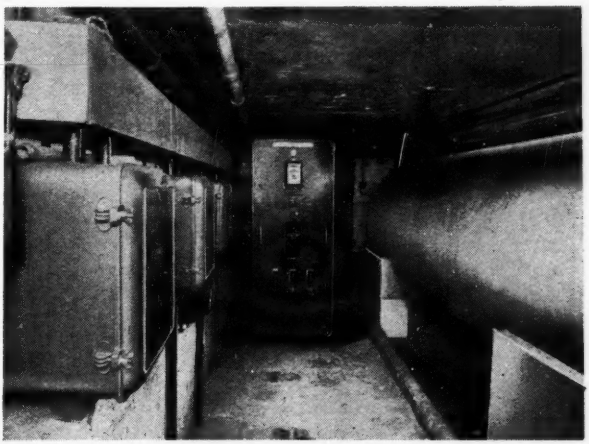
Public Baths Scheme

Wartime Steam to Electric Conversion

THIS is an account of how, by the ingenuity in improvisation of a supply engineer and his staff, wartime difficulties were successfully overcome in a steam to electric conversion scheme for the supply of hot water in a public baths.

In the town concerned the use of the public hot-water baths so increased as the result of an influx of evacuees and the stationing of Service men in the district that the capacity of the existing coal-fired boiler system became inadequate. It was therefore decided to install a larger system and to take advantage of the opportunity to adopt the modern form of water heating—electric.

Urgency and financial considerations made building alterations undesirable, so that the main engineering problem was how to make the best possible use of the existing room for the boiler—a chamber measuring about 16 ft. long, 8 ft. wide and 7 ft. high. As 1,400 gallons was a desirable boiler capacity and a boiler of this size could just be accommodated, this figure was settled on for the scheme which also provided for the conversion to electric heating of two existing 100-gallon cylindrical tanks to be used in the first place to boost the existing coal-fired system while awaiting the delivery of the boiler, secondly to keep the service at least partially going during the change-over period, and finally to boost the new boiler.



The main engineering problem was how to make the best possible use of the existing room for the boiler; the chamber measures about 16 ft. by 8 ft. by 7 ft. high

Ten 3-kW standard immersion heaters were fitted horizontally in the wall of each booster tank near the bottom, so that the total booster loading was 60 kW. Holes were cut for the elements and at each entry a 2-in. pipe coupling was welded to the cylinder to serve as a boss for receiving the screw-in immersion heater. The tanks simply ran in series hydraulically with the coal-fired boiler.

Erection of the main boiler at the later stage was a knotty problem because of the lack of head-room, and for the same reason the old boiler had first to be cut up into small pieces for removal. The new boiler was secured in four horizontal sections and these were electrically arc welded section by section on site. The boiler rests on three brick and concrete supports, or cradles, measuring about 3 ft. 6 in. by 1 ft. 6 in. at the floor level, with concave top surfaces to fit the boiler periphery. During erection rollers were placed between these supports and the boiler sections, so that the sections could be turned round as the welding work progressed.

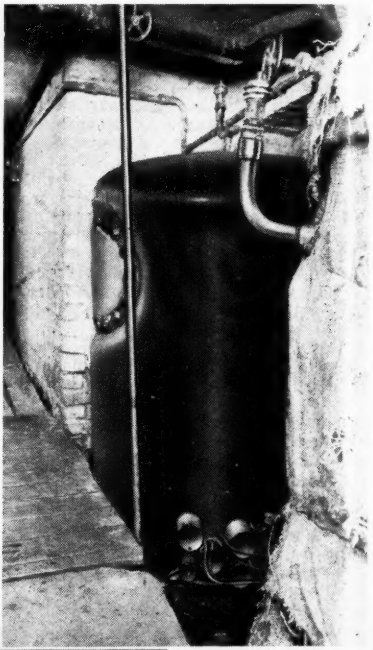
The next tricky problem arose from the difficulty of obtaining provision for the usual withdrawable-type water-heater banks, so another improvisation was the adoption of single immersion heaters. Holes were cut for these and 2-in. threaded bosses were welded to the boiler shell at the inlets to receive the heater heads. Similarly, holes were drilled and half-inch gas-threaded bosses were welded to the shell to receive thermostats.

The boiler is 14 ft. long and 4 ft. 6 in. in diameter. The total loading of 72 kW is made up of 20 G.E.C. immersion heaters disposed as two lines at different levels horizontally along and near the bottom of the boiler. Some of the heaters are loaded at 5 kW each, some at 4 kW and some at 3 kW, according to what were available at the time. The bottom line of immersers is about

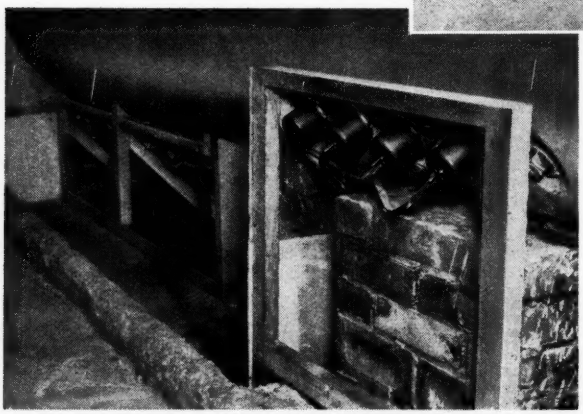
six inches above the lowest periphery line of the boiler on the "open" side, or they may be said to constitute two lines or groups at the same level, each line or group being between each facing pair of brick and concrete supports, *i.e.*, on each side of the central support. Similarly, the top line of immersers is in three sections of four immersers each over the three supports and along a line about 18 inches above that of the bottom heater units. The top heaters are disposed in the boiler at an angle of 30 deg. from the horizontal, while the bottom immersers project into the boiler along a line of 15 deg. from the horizontal. The three thermostats are located one near each end and one near the centre of the boiler, just above the bottom immersion-heater line, and these, too, project into the boiler along a line at 15 deg. from the horizontal. All the heaters are spaced along the boiler at about 8-in. centres.

Hot water is taken from the boiler at a point about a foot from the top level by means of a 2-in. bore outlet pipe projecting vertically and centrally into the boiler near one end of the drum. The inlet is near the other end of the drum *via* a tee to effect distribution along the bottom or cool zone of the boiler. The complete surfaces of both the boiler and the booster tank are served with about three inches of heat-resisting lagging to reduce the installation heat losses to a minimum.

One of the booster tanks still runs in series hydraulically with the boiler as part of the complete installation which is supplied



One of the booster tanks operates in series hydraulically with the boiler as an essential part of the installation



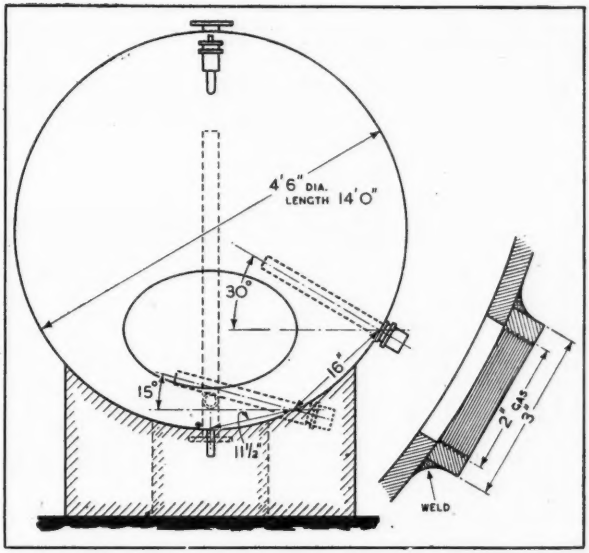
The total boiler loading of 72 kW is made up of 20 standard type immersers disposed in two lines

electrically on the off-peak principle under normal overall time-switch control, the setting of the time switch being arranged by the local supply authority. For emergency use, however, there is an additional overall control scheme by which the heaters can be switched on and off at the supply undertaking's distribution centre by means of a pilot cable.

Within the limits of the overall control there is automatic thermostat control at about 180 deg. F., with a thermostat differential of ± 5 deg. F. Each thermostat controls a 24-kW bank of heaters in the main boiler, and the heaters in the booster tank are similarly controlled. The thermostat in each case operates an Igranic contactor by which the actual bank supply circuit is "made" or "broken." The actual heaters are supplied individually at 230 V phase-to-neutral, but

the whole electrical scheme is balanced over the 400-V three-phase supply. The contactors are served by a covered-in busbar system, the main supply to which is governed by an "out-of-service" high-voltage truck-type oil circuit-breaker — another useful wartime improvisation.

The hot-water system serves about a score of normal hot-water baths which comprised the original coal-fired boiler installation, as well as a line of a dozen shower baths which were installed at the time of the conversion as a special service to Forces men stationed in the district. The old plunge bath had already been replaced by new open-air swimming baths in the town, so the opportunity was taken to install the showers along one platform of the old pool. The water system operates on the push-through principle with balanced pressure, but to ensure safe operation the boiler is fitted with a suitable safety valve.



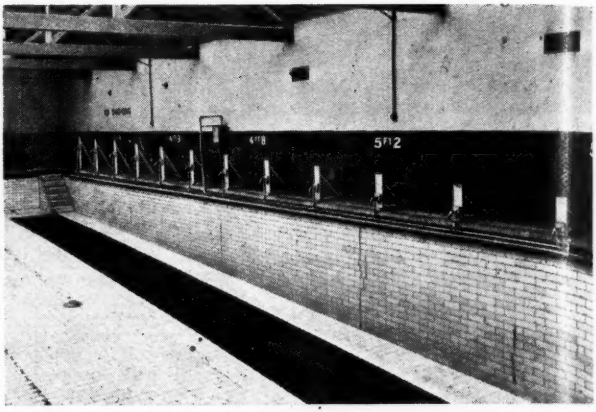
The boiler rests on brick and concrete cradles, and the immersers screw into bosses welded to the boiler

A subsidiary but essential part of the installation is a towel-drying cabinet which was also converted from steam to electric heating. The cabinet is brick built as an integral part of the building and measures about 5 ft. wide, 5 ft. high and 4 ft. deep. In it are housed side by side four vertical drying racks which run in and out on floor rails, and when these are all fully in, their fronts completely close the front of the chamber. In the side walls of the chamber are recesses which used to accommodate the steam-heating coils, but which now house specially constructed electric heating units. Each unit consists of an angle-iron frame

An essential part of the installation is a converted steam to electric towel-drying cabinet

measuring about 2 ft. 6 in. square by 6 in. deep, and within this framework are three element trays equally spaced vertically up the frame.

Each tray is fitted with a nickel-chrome resistor in zig-zag formation horizontally from end to end along the tray. The back and end walls of each unit are completely closed in by sheet-iron, while the front is of mesh construction; but the tops and bottoms of both units are open to create hot-air circulation down through the chamber and up through the element units. Each tray is loaded at 1·5 kW, so that the total loading of the cabinet is 9 kW. Each unit is balanced on the three-phase supply, the individual trays operating at 230 V phase-to-neutral. The whole of the heating is thermostatically controlled at about 150 deg. F.



The hot-water system also serves a line of shower baths with which the old plunge bath has been equipped

The complete installation has now been in actual operation for a little over a year, and the working results have been highly successful. Apart from such economical considerations as the saving in coal-storage space and the absence of a boiler attendant's wage bill, increased cleanliness has been a notable and pleasing feature, while, probably most important of all, the storage capacity of the installation has enabled sudden service demands to be met without unduly lowering the temperature of the hot water. The consumption during the first year's working was 245,250 kWh and the present price of the electricity supplied is 0·4624d. per kWh.

Forthcoming Events

Institution of Electrical Engineers.—Thursday, April 29th, 5 p.m. Films of Lord Hirst and Dr. F. B. Jewett. 5.30 p.m. Thirty-fourth Kelvin Lecture: "Mechanical Integration in the Solution of Electrical Problems," by Prof. D. R. Hartree, M.A., Ph.D., F.R.S.

Wireless Section.—Wednesday, May 5th, 5.30 p.m. Paper: "The Frequency Synthesiser," by Mr. H. J. Finden.

Installations Section.—Thursday, May 6th, 5.30 p.m. Paper: "The Protection of Structures Against Lightning," by Mr. J. F. Shipley.

Transmission Section.—Wednesday, May 12th, 5.30 p.m. Papers on "Protective Systems for Rural Distribution up to 33 kV," by Messrs. D. C. Field, B.A.; O. Howard; and R. W. Steel and A. W. Allwood, B.Sc. Paper on "Automatic Selective Isolation of Sustained Earth Faults on Networks Protected by Petersen Coils," by Mr. K. I. Brown.

South Midland Centre.—Monday, May 3rd, 6 p.m. James Watt Memorial Institute, Birmingham. Informal discussion on "The Shape of Things to Come."—*Students' Section.*—Wednesday, April 28th, 6.30 p.m. "Brains Trust."

North-Western Centre.—Tuesday, May 4th, 6 p.m. Engineers' Club, Manchester. Annual meeting and paper on "Busbar Protection—a Critical Review of Methods and Practice," by Messrs. M. Kaufmann and W. Szwander.

North-Eastern Students' Section.—Friday, April 30th, 6.30 p.m. Neville Hall, Westgate Road, Newcastle-on-Tyne. Annual meeting and film night.

London Students' Section.—Saturday, May 1st, 6-10 p.m. Lysbeth Hall, Soho Square, W.1. Dance (tickets 3s. 6d. single; 6s. 6d. double).

North Midland Students' Section.—Saturday, May 1st, 2.30 p.m. Griffin Hotel, Leeds. Paper: "A Gas-filled Cable System," by Mr. B. Calvert, B.Sc. (Eng.).

Nottingham Society of Engineers.—Monday, May 3rd. Corporation Gas Showrooms, Parliament Street. Lecture on "Gear Cutting," by Mr. F. J. Everest, M.Sc., A.M.I.E.E., A.M.I.Mech.E.

Junior Institution of Engineers.—*Midland Section.*—Wednesday, May 5th, 6 p.m. James Watt Memorial Institute, Birmingham. Paper: "Compilation of Technical Papers and Lectures," by Dr. W. Wilson, M.I.E.E.

Improving Electricity Supply–II

A Comparison of Merits of Alternative Schemes

THE whole question of reorganising the electricity supply industry is, of course, extremely complex, but many statements have been made in high places which reveal that the various implications are not fully appreciated. It took Lord McGowan and his committee many months of careful investigation to produce their report so that too much attention should not be paid to hastily conceived schemes of visionary theorists, especially while the war is in progress and while practical men in the industry are too busily engaged on work relating to the war effort to be able to spare much time even for such an important matter. The interest that is being taken in the future of electricity supply in Government circles is evidenced by the fact that there are now at least seventeen committees, most of them appointed by the Ministry of Works, dealing with matters concerning electricity. No doubt the new Ministry of Town and Country Planning will uphold tradition and produce several more. What is somewhat surprising is that these committees seem to set about their various tasks with little or no reference to the Ministry of Fuel and Power, which is vitally interested.

It appears to be generally agreed that some improvements in the electricity supply industry are necessary and the war seems to have brought the matter into greater prominence. In a previous article the problems facing the industry were briefly outlined. We now review some current opinions on the subject

A Ministry of Fuel Policy

Though, of course, the lines on which development will take place depend on the Government in power when the final plans for the reorganisation are being settled, it would in the meantime be of considerable assistance in working out any scheme for improvements if the Ministry of Fuel and Power could give a lead as to what its policy is likely to be on the whole range of fuel industries under its control.

Incidentally, in formulating this policy it is essential that in regard to electricity the Ministry should consult the supply industry direct.

A constructive move was made by the Electricity Commissioners, following the statement in the House of Lords by Lord Portal last June, in requesting the most important associations connected with the industry to put forward proposals for the post-war reconstruction of the industry. In this matter the industry is severely handicapped by the various conflicting interests, and, while the Joint Committee of Electricity Supply Associations is actively engaged in endeavouring to produce a common policy, it seems inevitable that, although agreement may be reached on many important matters such as the standardisation of voltage and system, uniformity of tariff structures and uniform standards of consumer service, there must be a cleavage of opinion as soon as such fundamentals as ownership and control of the industry are involved. On this main issue such a committee can never hope to reach agreement. The local authority interests as represented by the Council of the I.M.E.A. have laid down their definite policy that reorganisation should provide for complete public control and public ownership. (In this connection it is worth bearing in mind that public control does not necessarily mean municipal control.) The companies must obviously take the entirely opposite view. They stand for private ownership with perhaps some of them willing to consider some measure of public control. It would, however, be very desirable indeed for any agreed scheme covering all the aspects of electricity supply to be put forward jointly by the various sections of the industry, and it must not be too readily assumed that the scheme ultimately found most acceptable will not be one combining some groups of undertakings under public ownership and control and other groups under the ownership and control of companies, with, however, definite limitations on profits and more clearly defined obligations to the public.

Improvement the Only Justification

Though the fact sometimes appears to be overlooked, the only justification for interference with the electricity supply industry is the certainty of improvement of the service to the community. This could be achieved either by (preferably voluntary) improvement and to some extent standardisation of the facilities offered by individual undertakings throughout the country, or by the elimination of the less economic undertakings which have not the means for development at their

disposal. The latter method might be carried out by grouping on the lines of the McGowan Report, by regionalisation or by nationalisation. Whichever of these means is favoured it should be borne in mind that for many years the tendency has been towards a reduction in the number of undertakings and that any alterations made in the organisation of the industry will be only an acceleration of this process.

During the past few weeks we have had the opportunity of discussing with a large number of men connected with the industry which of these lines of approach is likely to yield the best results. So widely conflicting are the views expressed and so emphatic are they that it is extremely difficult to discover a general line. But it would appear that, while with few exceptions there are few advocates of complete nationalisation in the near future (though some regard it as the ultimate objective), there are several who favour going a stage further than the McGowan proposals and instituting regional distribution boards.

But what is nationalisation? We already have a great deal of nationalisation without calling it that, and there are so many degrees and variations that it is somewhat difficult to distinguish where it begins and where it ends.

As we see it, it is rather national ownership than national supervisory control that is principally objected to, and a more positive Government declaration of policy towards the direction of the industry would generally be welcomed. An important suggestion has been made that the Electricity Commissioners should be strengthened by the addition of representatives from municipal and company undertakings who have been in day to day contact with consumers.

Effect upon Initiative

Anyone who imagines that there would be immediate benefits under nationalisation in the ownership sense—and big benefits would be expected—is liable to be disappointed. Among the many objections raised to it are that it provides little incentive for initiative, enterprise, vision or courage (Lord Portal stated that 80 per cent. of the success of an undertaking depended on its management); that it would almost entirely eliminate local management as the district engineers would not find room for their own personality and views; that the industry should be left in the hands of personnel skilled in engineering as well as administration; that it is too impersonal for such a "personal" service as electricity and that it would introduce the "Civil Service" mentality, red tape and reference back to higher authority (this disadvantage particularly applies to trivial matters); that there would be difficulties in securing uniformity throughout the country; that no Government can successfully deal with merchandising, since it is unable to take the "short cuts" so necessary in business; that if nationalisation is to be the order of the day, there are many other essential industries which should be dealt with first, or at any rate, simultaneously; that it would result in there being one purchasing body for apparatus, this having very far-reaching effects on industry as a whole; that as in the case of the Post Office it would provide a ready means to the Government of finding additional revenue (*e.g.*, raising the postal rates from 1½d. to 2½d.).

Those favouring nationalisation state that operation on a grander scale would facilitate the standardisation of voltage and changeover from DC to AC (but probably not any more than a scheme of levies or subsidies would do); the levelling of prices (though by no means certainly cheaper electricity), and also the undertaking, possibly at lower cost due to the unified control, of national post-war schemes of industrial and rural development (though this development work could undoubtedly be performed efficiently under the existing organisation of the industry).

The Post Office Comparison

Although by no means strictly comparable, the Post Office is frequently held up as the sort of model which the electricity supply industry should follow, but has the G.P.O. really so much to congratulate itself upon? True its postal service is available to everyone in the country at uniform rates. On the other hand, since the war its charges have been advanced by 66⅔ per cent. for letters, 100 per cent. for postcards, and 15 per cent. for telephones (still further raised by the new Budget), while electricity rates are generally unchanged or only slightly higher—in a few cases actually lower than before the war. The fact that the heavy increases in postal charges are primarily intended as indirect taxation cannot be considered much of a consolation. Moreover, telephone charges are *not* the same all over the country, irrespective of distance, though standard rates are fixed for comparable distances. With regard to development, too, the telephone service does not bear comparison with electricity.

Presumably with complete nationalisation there might, if the C.E.B. were retained, be a Distribution Board set up by the Ministry of Fuel and Power on somewhat the same lines as the C.E.B. The latter body has undoubtedly proved its worth but it does not necessarily follow that a distribution board, with widely different functions, run on the same lines would operate with equal success. The grid has certain technical advantages but nothing similar is to be expected from a similar control of distribution. In the Weir Report (1926), on which the Act setting up the grid was based, there appears the sound statement that "the detailed distribution of electricity . . . is essentially a local

matter and a suitable function for decentralisation." In any case a much greater degree of local control and personal contact is necessary on the distribution side and this would inevitably suffer if an attempt were made to operate with unwieldy areas. Furthermore, although some economies could be made, there are not the same savings to be effected on the distribution side as there are in generation in order to meet the establishment charges involved.

An argument that has been advanced by "nationalisers" is that as most undertakings now take a bulk supply from the grid, their distribution systems might as well be taken over too. Actually undertakings received Parliamentary powers to *supply*, not necessarily generate, electricity, and the possession of a power station is almost as irrelevant as the ownership of the coal field from which the energy is ultimately derived. In effect, the grid presents an example of an "expedited evolutionary" process in that the linking up of power stations was previously common practice, though on a much smaller scale: nationalisation of distribution would be a revolutionary measure which would have no roots in the past history of electricity supply with its wealth of experience.

Composition of Local Boards

Something more "alive" than nationalisation seems, therefore, to be required, and local distribution boards have been suggested as possibly solving the problem of decentralisation, either as subsidiary to a National Distribution Board, or as more or less autonomous bodies under some sort of supervisory control. On the composition of these local boards, of course, depends the degree of national control achieved and also the degree to which the merits and demerits of nationalisation referred to above would operate. At one extreme the personnel might be appointed by the Ministry of Fuel and Power, or the National Distribution Board, while at the other it might consist of local representatives of the municipal and county councils, employers and labour organisations, and the consumers.

An example of an arrangement at the latter end of the scale is to be found in the plan put forward by the London & Home Counties Joint Electricity Authority to bring about a compulsory grouping of undertakings in London and South-East England. Incidentally, to mention one of the criticisms of this particular scheme, it is very much doubted whether a single authority could carry out efficiently the administration for electricity purposes over the very large area proposed. In support of this, the McGowan Committee in its report stated that it was not satisfied that the Greater London Area with its vast population and its many different characteristics was a suitable area to be administered as one unit from the point of view of the distribution of electricity.

The London J.E.A. itself and the other two J.E.A.s now operating are, of course, a step in the direction of co-ordination, but this form of amalgamation has not "caught on." They have the disadvantage of possessing a background of politics, and it is rather difficult to visualise that a system of joint authority administration, as constituted today with its somewhat complicated and tedious procedure, would effect within a reasonable time any satisfactory general solution of the problem. Another form of organisation is the Joint Boards, consisting of representatives of local authorities. The five that have been formed are apparently operating quite satisfactorily and it is rather surprising that this method of securing voluntary merging of undertakings to their mutual advantage has not been more widely adopted.

There are, of course, already many precedents for public utility boards. Besides the Central Electricity Board, there are, for example, the London Passenger Transport Board, the British Broadcasting Corporation, the Metropolitan Water Board, and the Port of London Authority. Whether they perform their functions satisfactorily or otherwise is to be judged by the results achieved. The services undertaken by these organisations differ widely from electricity supply, and what may prove suitable for them may not succeed equally well for handling the more complicated structure of the electricity industry.

Generation Only?

It is, of course, quite conceivable that a scheme might be introduced for the nationalisation of generation without nationalising distribution. Though it would be opposed in many quarters this arrangement would find many supporters on the assumption that it would get over the difficulties of Section 13, that it would facilitate the immediate introduction of a standard grid tariff, and help to a certain extent in the unification of charges to consumers. We have also heard the suggestion that, in addition to generation, the Central Electricity Board should own and operate all transmission lines (20 kV and over). This would, it is claimed, result in removing some of the anomalies in bulk supply charges. However that may be, the distribution side of the industry will inevitably tend to become more and more a retail business.

In our next article we shall continue our investigations into the alternatives to national and regional control and consider the arguments put forward by those who consider that the industry's best interests would be served by development on the lines of the McGowan Report.

Rewinding Armatures

Repairing Universal Motors for Small Machine Tools

By R. Newing, A.M.I.E.E.

THE applications of the type of motor in which the winding of a stationary field is in series with that of a rotating armature fitted with a commutator are limited, as its speed is dependent upon the load. Nevertheless, owing to its compactness and high starting torque it is invaluable for such drives as small machine tools, portable drills, fans and vacuum cleaners.

The author states that owing to the present difficulty of and delays in having small motors rewound this article may be useful to works electricians who are in a position to undertake the rewinding themselves

When rewinding an armature the position of the ends of the coils on the commutator must first be determined accurately from the construction of the motor, its direction of rotation and its full-load speed. Most machines have fixed brushgear so that the position of the coil ends on the commutator is important.

Armatures are usually lap wound and for normal-speed and reversible machines the coil ends are brought out so that the coil is under commutation when it lies in the magnetic neutral axis as shown in figs. 1 and 2. The armature coil is shown wound in two circuits with, as is usual, twice the number of commutator bars as slots. In fig. 1 the ends of the armature coil could be brought out on the right under the other brush, in which case they would be connected to bars 18, 19 and 20.

With motors running at over 3,000 RPM, the brushgear would require a backward shift in order to facilitate commutation, but where the brushgear is fixed this cannot be done. With machines built for one direction of rotation the same effect is obtained by bringing the armature coil ends further round the commutator in the direction of rotation. The armature coil ends should be connected to bars 8, 9 and 10 for a clockwise rotation and to 4, 5 and 6 for an anti-clockwise rotation. The same applies to fig. 2, where the brushes are in line with the poles. In this case the ends should be connected to bars 14, 15 and 16 for clockwise rotation and to 10, 11 and 12 for anti-clockwise rotation (looking towards the commutator).

If the direction of rotation is not known (*e.g.*, if the armature only is available) particulars of the faulty winding must be obtained before it is stripped. This may have to be done by testing, as the wire is so fine that, owing to impregnating and stoving, it is usually impossible to ascertain by inspection alone to which of the bars the coil ends are connected.

A simple way of ascertaining this is to connect a low-reading ammeter (0 to 1,000 mA or 0 to 5 A) in circuit with a 1½-V cell. One lead can be connected to a sharp steel point for piercing a coil and the other connected to the commutator. The bars to which a particular coil is connected can then

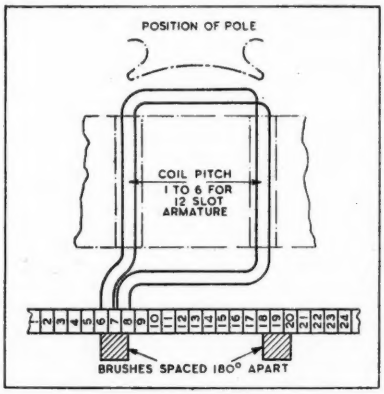

POSITION OF POLE
COIL PITCH
1 TO 6 FOR
12 SLOT
ARMATURE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
BRUSHES SPACED 180° APART

Fig. 1.—Brushes between poles

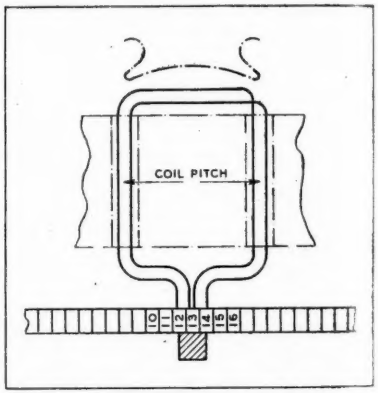


Fig. 2.—Brushes in line with poles

be determined by the highest readings obtained on the meter.

Since the direction of rotation is dependent upon the direction of the current through the armature coils, if the two top ends in fig. 1 were connected to bars 7 and 8 and the bottom ends to bars 6 and 7, the direction of rotation would be reversed. Normally this is not important, as the direction of rotation can be corrected by reversing the direction of the current through the field coils with respect to the armature.

The correct connections can, however, be determined by testing before the armature is stripped. If, for instance, a 1½-V cell is connected across two commutator bars, a compass or polarised needle held in line with the axis of the corresponding coil will be attracted or repelled as shown in fig. 3. This test should be carried out after the test for determining the bars to which a particular coil is connected, as it is necessary to know against which side of the armature to place the compass.

These tests can be carried out successfully even if the armature is burnt out, as at 1½ V the charred insulation is sufficient to prevent any short-circuit upsetting the tests.

The following information required for rewinding can be obtained from the old

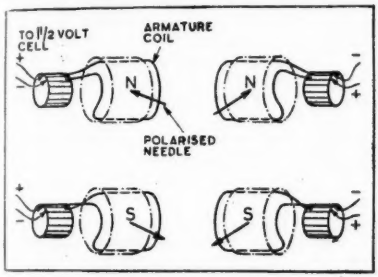


Fig. 3.—Tests for determining correct connections

winding :—Coil pitch; number of conductors per coil; and size and covering of wire. The coil pitch is usually not quite 180 deg. round the core, the usual figures being for 7 or 8 slots, 1 and 4; for 9 or 10 slots, 1 and 5; for 11 or 12 slots, 1 and 6; and for 13 or 14 slots, 1 and 7.

If the winding external to the core is cut away close to it, the whole of the conductors can usually be driven out of a slot. The number of conductors per coil is half the number per slot, as each slot accommodates the top of one coil and the bottom of another. The number of circuits in each coil depends upon the number of commutator bars. If the number of bars is twice that of the number of slots, a coil will consist of two circuits each having the same number of turns. Similarly, if there are three times as many bars as there are slots, each coil will consist of three separate circuits.

The size of the wire is best determined by a micrometer, as for 230-V machines it is usually less than 32 SWG and may be as small as 42 SWG. The wire is generally enamelled and single-silk covered or, if sufficient room is available in the slots, enamelled and single-cotton covered. If the wire for rewinding has to be obtained especially, silk should be specified if there is any doubt as to the nature of the original insulation.

The difference in the thickness of the silk and cotton covering is considerable, as is shown in the accompanying table which gives

SWG	Enam. & S.S.C.	Enam. & S.C.C.
32	360	220
34	480	270
36	650	400
38	960	530
40	1,400	730
42	1,900	not obtainable

the approximate maximum number of turns that could be packed into a winding space having a cross sectional area of 0·0625 sq. in. (¼ by ¼ in.). Owing to the lay of the wires, however, it is estimated that only some 65 per cent. of these turns could satisfactorily be *wound* into a slot having a winding space of this cross-sectional area.

Rayon Insulation

Pure silk cannot be obtained at the present time and artificial silk (rayon) is supplied in its stead. The latter is generally similar to pure silk in regard to thickness and insulating properties but it is more susceptible to abrasion. It withstands impregnation quite well, but more care is required during winding. For slot insulation one thickness of 7/10-mil empire cloth and one of 7/10-mil leatheroid are sufficient. If the empire cloth is arranged between the leatheroid and the slot, winding will be easier.

The majority of armatures hand-wound with this class of wire have no extra insulation between the coils either in the slots or external to them. Although the voltage between adjacent conductors at various parts of the armature may be quite high, experience shows that the amount of trouble due to short-circuits is on the whole very small if the armature is thoroughly dried out before impregnation.

In most cases the coils are hand-wound progressively round the core as shown in fig. 4 (a). Two circuits forming one coil can be wound together from two reels of wire to save time. The coils of some armatures are wound in " V " formation with half of the turns of each circuit on each side of the shaft as shown in fig. 4 (b). The ends of the circuits forming the coil are brought out for connection to the commutator at the slot

which is common to both halves of the winding. This arrangement makes a more balanced winding, but takes up more room external to the core, and with some armatures there might be insufficient space between the core and commutator to accommodate it.

Most people when winding a small armature of this class for the first time find greatest difficulty with the coil ends. In my opinion the easiest way is to leave the ends of the coils protruding from their slots as shown in fig. 5 until the armature is wound. The two top ends can be knotted together for identification and the two bottom ends then doubled back to the commutator end of the slot before the slot insulation is cut off and the fibre wedges inserted. The four ends (assuming two circuits to a coil) then enter a slot containing the top of their coil and are therefore easily identified. The two bottom ends of each coil can then be sweated into the commutator. After placing over these a layer of insulation, such as oiled silk, the two top ends can be brought down to their bars, the testing of the individual circuits being carried out by a bell and battery or similar method. A final test between adjacent bars can be made with a 1½-V cell and a milliammeter instead of employing the usual drop test method.

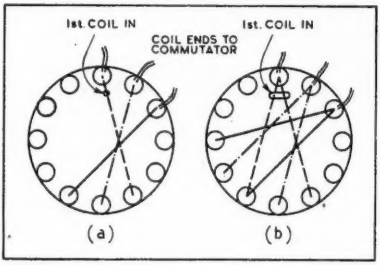


Fig. 4.—Methods of hand-winding coils

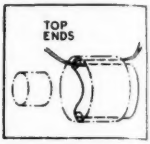


Fig. 5.—Treatment of coil ends

With hand-wound armatures the readings between bars will differ somewhat as the first coils put in will have a lower resistance than those of the last coils. Short-circuits between turns are unlikely and the main reason for this test is to make sure that there is no short circuit between bars due to soldering and that no mistake has been made with the connections. The armature should be stoved until all the moisture is dried out and it should then be impregnated while hot and stoved.

Many burn-outs are due to the failure of the commutator. Adjacent bars should be tested with a voltage not exceeding 45 V and the commutator tested as a whole to earth with a "Megger" before winding is commenced. A "Megger" should not be used for testing between bars as this is liable to break down good insulation which is normally subjected only to a low voltage.

A Mobile Accounts Department

County Company's Enterprise

A NOVEL means of collecting accounts has been adopted in the Purley area of the County of London Electric Supply Co. Ltd. The company's Purley office controls about 75 sq. miles, and serves some 80,000 consumers. In peace-time several small outlying showrooms were maintained, but under present conditions when drastic economy is necessary in staff and there is little or no apparatus to sell, the company has been compelled to close some of these. As a result complaints were received from these other outlying districts not served by showrooms that no facilities were provided for the payment of accounts locally, thus putting consumers to expense.

The County Company's travelling office

To overcome this trouble, and with a view to economising in the use of labour to the maximum extent, it was decided to try the experiment of constructing a small wheeled caravan, or portable office, which could be towed behind a small 8-HP car. This has been duly constructed from odd material by staff who would normally be engaged on stand-by duties. The facilities offered have been greatly appreciated by consumers and have resulted in favourable comment on the company's enterprise in the local Press.

Post-War Installations

Recommendations of Ministry of Works Committees

IT will be recalled that under the auspices of the Directorate of Post-War Building of the Ministry of Works twenty-three Study Committees were convened by the appropriate bodies to consider various aspects of building and to make recommendations with regard to practice to ensure the speedy and efficient erection and equipment of buildings after the war. Among them is the Electrical Installations Committee convened by the I.E.E. and composed of representatives of the Institution, contractors, supply authorities, manufacturers, etc. Mr. J. R. Beard, past-president I.E.E., is chairman.

Terms of Reference

The proposed lines of operation were (1) To review existing information and practice concerning installations in buildings for (*a*) the supply of electricity for all purposes from the point of entry of the current at the property boundary to the point of its delivery to an appliance, and (*b*) all forms of electrically-operated telecommunications; (2) To make recommendations for practice in post-war building.

In common with a number of the other committees, the Electrical Installations Committee has prepared a draft interim report, a summary of which has been provided by the Ministry of Works. In this attention has been confined to types of building which will have priority after the war. Further draft reports are being prepared on installations, appliances and telecommunications in larger houses and flats, offices, business buildings, hotels, hospitals, shops, stores and farm buildings.

Influence on Design

Special emphasis has been laid on those aspects of electrical installations which may influence planning and function and design of buildings, so that they may be considered by appropriate Study Committees at an early stage. The Committee has recommended only those amenities which it considers can be obtained at a reasonable cost. Small houses (of the council estate type) and low-rental flats have been the Committee's main concern, but many of its recommendations apply also to larger premises; the proposals are also generally suitable for Scotland.

It is considered that the application of standards to consumers' supply control would effect improvement in services and that every domestic consumer should be regarded as a potential user of electricity for lighting, cooking, water heating and space heating. It is assumed that tariffs will be such as to require one meter only and correspondingly simplified wiring.

The Committee recommends that 0·0225 sq. in. twin p.i.l.c. unarmoured cable to B.S.S. 480/1942 should be standard as the minimum to meet initial and potential development. A larger cross-section may be necessary where the service cable is over 30 yards long, and if the anticipated loading exceeds 15 kW 0·04 sq. in. twin cable to the same specification should be used. With regard to service cables to flats the Committee considers that the supply authorities should have control of the distribution network up to the eventual consumer's terminals but makes no definite recommendation at this stage.

As to consumers' supply control, the Committee recommends a standard form of apparatus and mode of installation for small dwellings; that meters of the same function and capacity should be standard as regards terminal arrangement, external shape, dimensions and fixing bolt centres; and that, pending the development of a combined unit, the type of fitting which serves as cable sealing box and main fuse box should be standard in two sizes for the 0·0225 and 0·04 sq. in. cables.

Compact Units

Details and illustrations are given in the report of forms of housing for the main fuses and control and it is recommended that consideration should be given to achieving still more compact control by assembling the meter unit and switch-fuse in one metal or plastic case with the meter plugged into the control unit. Such units could be conveniently situated and mass production would be facilitated.

Consumers' supply control should be housed separately from other services to avoid contamination by gas or water.

Dealing with installations in small houses and flats, the Committee discusses the advantages and costs of complete electrification and makes recommendations under the headings of lighting, general utility socket-outlets, occasional fires, cooking, water heating, refrigeration, general space heating and laundering.

It is recommended that an adequate number of socket outlets of standard size should be provided for the connection of portable appliances and that, for simplification and interchangeability, a 10-A outlet and fused plug of the flush mounting type should be standard throughout the country for small dwellings. Socket outlets should

be mounted at about 9 in. from the floor level and possibly higher in the kitchen.

For small dwellings there should be three separate circuits, each controlled by separate single-pole fuses—lighting, socket-outlet "ring" circuit and cooker circuit. Special kitchen appliances should be supplied from the ring circuit, which might have to be increased appropriately in rating and this circuit might also be used for standard lamps. It is thought that the use of rewirable porcelain fuses should be abandoned in favour of a standard ready-wired enclosed fuse.

The new opportunity for co-operation with architects at an early stage is welcomed and wiring systems are discussed. It is recommended that, failing the provision of a planned system of ducts and ways, screwed or grip-joint conduit should be used. Ducts, etc., particularly in skirtings and between floors would increase flexibility of installation and make a choice of wiring system possible.

Flush-mounted Accessories

For domestic use flex smaller than 23/·0076 should be eliminated. With any system of wiring all switches, socket-outlets and other permanent accessories should be flush mounted. Consumers' fuses should be labelled and there should be a diagram showing cable runs.

Ducts in pre-fabricated wall sections providing for flexibility in the installation would be welcomed. It is considered to be immaterial from the tenant's point of view whether central heating in flats should be by electricity, gas or other fuel and the question of the extent to which central heating is desirable is thought to be one for the Heating and Ventilating Committee to decide. It is suggested, however, that central systems should provide "background" heat only, small radiant fires being used to "top up." Many or all of the advantages of central hot water can be more economically obtained by using individual electric water heaters which avoid waste of unmetered common supply.

A preliminary examination has been made of draft plans by the School Planning Group and the Committee makes recommendations under the headings: intake, wiring system and layout, pre-fabrication, additional circuits, heating and lighting. At this stage consideration has been given only to matters affecting construction in order to ensure suitable provision for the electrical installation.

The Gas Installations Committee has also prepared a draft report in the course of which it is pointed out that the design of gas appliances has been hampered by the fact that they are usually installed as additions to existing solid fuel appliances, or fixed in positions not primarily or adequately provided for them. If certain provisions were made, the appropriate type of appliance for any form of fuel could be installed without difficulty. It is recommended that the Standards Committee should consider this matter in consultation with the coal, coke, gas and electrical industries to determine suitable positions and dimensions of openings into which domestic fuel appliances for any service could be fixed.

Recommendations are also made regarding details of installation of cooking, water heating and space heating appliances, refrigerators and flues for gas appliances.

The Sub-Committee on the Design of Houses and Flats refers to the very general demand for an improvement in kitchen planning and the introduction of labour-saving equipment and in its draft report suggests the use of immersion heaters in hot-water cylinders as an alternative to heating by solid-fuel fires.

In the course of its deliberations the Plastics Committee is giving attention to the use of plastic materials in electrical installations; conduit and electrical accessories are briefly referred to as possibly suitable subjects for plastics.

The Ministry of Works wishes it to be made clear that these reports are first drafts only. They do not express the views of the Ministry of Works or the convening bodies, nor do they carry the final approval of Study Committees themselves.

Electric Petrol Vaporiser

MR. H. C. Busbridge, borough electrical engineer of Swinton and Pendlebury, Lancashire, has devised means of electrically heating an induction manifold which assists the starting of a car without the use of a choke. The arrangement which he has demonstrated on a four-cylinder car is simple, but is advocated as an idea for incorporation in the design of the engine manifold rather than as an accessory to be added to existing cars, since it is not easily fitted to the usual type of combined inlet and exhaust manifold.

The heating element is a spiral coil of heavy resistance wire passing centrally along the entire length of the manifold. It is rated at about 60 W, say 5 A at 12 V, so adjusted that the wire will not become red hot and ignite the petrol. A dashboard switch with fuse and pilot lamp indicator enables the heater coil to be energised from the car battery about three minutes before starting the engine; it can be switched off after the car has travelled about two miles.

The presence of the heating element causes turbulence of the vaporised fuel that breaks up the spray coming from the carburetter jets, thus further assisting vaporisation, which is claimed to result in more efficient combustion of petrol when the engine is cool. Connection to the garage mains enables the heating element to be employed for keeping the engine sufficiently warm to serve as an adequate anti-freezing safeguard.

PERSONAL and SOCIAL

News of Men and Women of the Industry

LAST week **Mr. E. C. McKinnon,** the company's chief engineer, completed fifty years' continuous service with the Chloride Electrical Storage Co., Ltd. After a two-years' electrical engineering course at the Manchester School of Technology, Mr. McKinnon was sent by the late Dr. Edward Hopkinson to assist the late Mr. G. A. Grindle (works manager of the new Chloride Electrical Storage Syndicate), who was supervising the conversion by Mather & Platt of a former aniline works at Clifton Junction into an accumulator factory. He gained experience not only in designing and building batteries, but also in putting them to work and subsequently inspecting them periodically. He installed batteries on the Royal yachts in Queen Victoria's reign, in the first British submarines, and in many electricity works at home and abroad,.

After serving as chief inspector until 1904, Mr. McKinnon was appointed chief engineer to the company, and has held that position ever since. In the course of his duties he has travelled in many countries, where his knowledge of several languages has proved useful.

He has lectured at many universities and technical colleges and has twice secured premiums for papers read before the Institution of Electrical Engineers. He was chairman of the North-Western Centre of the I.E.E. in 1935-6. He has also written books and many technical articles, and is editor of the "Chloride Chronicle" and "Exide News." He has served on a number of committees and international commissions. During the last war, Mr. McKinnon spent considerable periods in Russia in connection with the British submarines stationed in the Baltic.

Dr. E. W. Smith, C.B.E., technical director of the Woodall Duckham companies, has been elected president of the Institute of Fuel for 1943-44. Until recently Dr. Smith was Director-General of Gas Supply in the Ministry of Fuel and Power.

The wedding took place on April 17th, at Nether Congregational Church, Sheffield, of **Mr. F. R. Haigh,** B.Sc., A.M.I.E.E., and **Miss M. L. Hemming,** Ph.D. Mr. Haigh, who is a past chairman of the North Midland Students' Section of the I.E.E., is on the engineering staff of the Yorkshire Electric Power Co., and Dr. Hemming is on the staff of the Chemistry Department of Sheffield University.

Mr. A. Murray Stephen, of Alex. Stephen & Sons, Ltd., Glasgow, was elected chairman of the Institution of Engineers and Shipbuilders in Scotland at the annual meeting of the Institution on April 13th in Glasgow.

Sir Eugene Ramsden, Bt., M.P., chairman of Richard Johnson, Clapham & Morris, Ltd., paid a tribute to nine of the company's employees to whom presentations were made to mark their long service at a recent gathering of the employees. The presentations, consisting of illuminated testimonials and war savings certificates, were made by **Mrs. A. L. Johnson,** wife of the deputy-chairman, to Messrs. W. E. Jackson and G. Yates, departmental managers; Messrs. H. W. Goodwin, G. T. Bowker, H. H. Taylor and F. Redfern, outside representatives; and Miss M. A. Carter and Messrs. W. H. Hurst and G. W. Thompson, all of whom have been with the company for fifty years or more.

Mr. P. S. Turner, assistant managing director of Associated Electrical Industries, Ltd., has been appointed chairman of the Council of the British Electrical and Allied Manufacturers' Association for the ensuing year. Mr. Turner has been a director of the A.E.I. since 1939 and was appointed to his present position last year. He is also on the boards of the Metropolitan-Vickers Electrical Co., Ltd., the Edison Swan Electric Co., Ltd., and Edison Swan Cables, Ltd.

Mr. P. S. Turner

He is well known for his work in connection with railway electrification, particularly that relating to the electrical equipment of the Hungarian State Railways.

The new vice-chairman is **Mr. L. W. Smith** (Elliott Bros.).

Mr. David Gray, C.A., has been appointed to succeed the late Mr. D. Robertson, F.C.A., as chief accountant of the County of London Electric Supply Co., Ltd., and associated companies. Mr. Gray, who was educated at George Heriot's School, Edinburgh, was articled to the late Mr. James Ivory, C.A., of that city and was admitted a member of the Society of Accountants in Edinburgh in 1922. He was a member of the staff of Price Waterhouse & Co., London, for eight years prior to his appointment as assistant accountant of the County of London Co. in 1931.

The *New Zealand Electrical Journal* reports the appointment of **Mr. Nelson Jones** as managing director of the National Electrical & Engineering Co., Ltd., in succession to the late Mr. E. W. Ackland, founder of the company, and **Mr. F. S. Taylor,** Auckland manager, has been appointed New Zealand manager. Mr. Jones came to England for post-apprenticeship training with Crompton & Co., Chelmsford, and he has visited this country several times since. At the close of the last war he spent some time at the Rugby works of the British Thomson-Houston Co., Ltd., which his company represents in New Zealand, and during the two years from 1923 to 1925 he visited works and manufacturers in England and on the Continent. He again came to England in 1933, visiting the B.T.H. Co. and returning to New Zealand in 1935 by way of the United States and Canada.

Obituary

Mr. Norman Robinson, managing director of Macrome, Ltd., died suddenly on April 7th, while on a business tour in South Wales.

Correspondence

Improving Electricity Supply

THE reference in your first article in this series to charges by the Post Office for inland postage gives me an opportunity of pointing out that the fees for this vital national service have, since the outbreak of war, been increased by 66⅔ per cent. as regards letters and 100 per cent. for postcards. Railway fares have also been raised substantially under national control, and it has just been announced that the Government has netted £40,000,000 from this source.

Charges for electricity, on the other hand have, on the whole, fallen during the past ten years, although the cost of coal has doubled. Surely this is an achievement of which the whole supply industry, not forgetting the Central Electricity Board, may justly be proud.

Some improvement in organisation is doubtless possible, but let all concerned, and more especially the users of electricity, beware lest some ill-considered "major operation" result in the last state being worse than the first.

In this connection, I am reminded of the cynic who said, "The political machine is constructed largely of cranks and eccentrics tied together with pieces of string called 'political expediency.'" Let us fervently hope therefore, that whatever else may befall, the future of electricity supply will be treated not as a political plaything but as an economic problem concerning a virile and highly progressive industry, already in very capable hands.

R. ALAN S. THWAITES.

Withington, Manchester, 20.

Firing Pottery

I HAVE just read the article on pottery firing in your issue of March 19th, and would like to refer to the statement made in your first paragraph that the kiln built at the Worcester Royal Porcelain Co.'s works is believed to be the first British-made continuous electric tunnel kiln operating at temperatures suitable for the china glost range.

In 1939, some two years earlier than the date of the Worcester installation, a continuous electric kiln for the glazing of china dinner and tea ware was erected at our works by G.W.B. Electric Furnaces, Ltd. This kiln has been in continuous service since August, 1939, and has given every satisfaction regarding the quality of ware fired, flexibility and economic running. Apart from experimental tunnel kilns built previous to this date, I think that the G.W.B. kiln can claim to be the first commercial size unit of this type.

GEORGE JONES & SONS, LTD.

Stoke-on-Trent. Stanley Harrison,
Managing Director.

The Wimbledon Pension

IN the King's Bench Division on April 14th, Mr. Justice Hallett had before him an action by the Attorney-General, at the relation of Mrs. Greta A. Lindner (wife of Councillor A. F. H. Lindner) of Wimbledon, against the Wimbledon Corporation for a declaration that the superannuation allowance of £2,045 which the Council proposed to pay its electrical engineer, Mr. A. E. McKenzie, was excessive.

Mr. Fortune, for the plaintiffs, said that in 1933 the Corporation reached an agreement with the London & Home Counties J.E.A. by which the latter took over the Wimbledon power station. It was part of the agreement that the J.E.A. should pay £3,000 towards the management expenses so long as Mr. McKenzie was chief electrical engineer.

Mr. McKenzie had been receiving a salary far in excess of what he (Counsel) thought would have been paid to an ordinary electrical engineer; his salary, with bonus, amounted to over £4,500 a year. When the matter of his pension came to be considered it worked out at £2,000 a year. He realised that Mr. McKenzie had served Wimbledon well, but Mrs. Lindner was acting in the public interest and thought it wrong that Wimbledon should pay the whole of the superannuation; the cost should be shared.

For the defence it was denied that any decision reached was illegal seeing that Mr. McKenzie had paid into the superannuation fund.

His Lordship said that he had to decide whether under the terms of the Local Government Superannuation Act, 1937, the payment was unlawful. There was no dispute as to the facts. It was plain that while Mr. McKenzie made his contributions to the fund he was entitled to the pension. The result was that the action failed and would be dismissed with costs.

"Measurements" Luncheon

A WELL attended informal luncheon of the Measurements Section of the Institution of Electrical Engineers took place at the Connaught Rooms, London, last week, with Mr. E. H. Miller, retiring chairman of the Section, presiding for the last time.

Professor C. L. Fortescue, President I.E.E., addressing the gathering, said that the Section had a large part to play in the I.E.E. and was unique in that hardly any of its papers or discussions was limited in interest exclusively to its own members. He suggested that when a paper was submitted that was of common interest to more than one Section it should be presented to a combined meeting. Members of the Measurements Section could in that way bring production aspects to bear upon the instruments involved in the method of measurement employed by members of the other Section jointly concerned.

In conclusion the President said that whereas instruments were steadily becoming smaller in size the Section membership was bound to grow.

Mr. E. H. Miller welcomed chairmen of other Technical Sections and Dr. R. L. Smith-Rose (Wireless Section) replying on their behalf remarked that as chairman of the oldest Section he felt proud that it had set such a good example to the others.

Gas-filled Cables

I.E.E. Transmission Section Discussion

THE paper by C. J. Beaver and E. L. Davey on "A High-Pressure Gas-Filled Cable," which was summarised in our last issue, was read at a meeting of Transmission Section of the Institution of Electrical Engineers on April 14th.

Mr. J. Hacking (deputy chief engineer, C.E.B.) opened the discussion. He said that this was the first paper submitted to the Institution on a development for which British cable engineers deserved considerable credit and it was rather overdue. This type of cable permitted a temperature rise up to 80 deg. instead of the 65 deg. which applied to the solid type, and that might not be the limit. In 1926 a one-mile loop was installed directly in circuit with the 132-kV heavily loaded overhead grid lines. It went into service in December, 1927, and had been entirely satisfactory. It had been in continuous service since November, 1941, and there had been no trouble. The Central Board had also made other practical applications of this type of cable for 132 kV, with quite satisfactory results.

It would have been useful to have had figures of the relative costs of the various types of cable mentioned in the paper. He was rather doubtful whether for 132 kV the gas-filled cable would cost less than the oil-filled cable, and unless economic advantages could be shown, he did not think the high-pressure gas-filled cable was likely to be used extensively, although it seemed that the gas-filled cable should be cheaper for 66 kV on account of its fewer accessories. On the question of impulse strength, he said that the C.E.B. had not had any serious troubles. This subject should be investigated by an independent body such as the N.P.L.

Not the Only One

Mr. P. V. Hunter (Callender's) said that this was not the only high-pressure gas-filled cable. His first acquaintance with the authors' system was in the patent specification and from this it appeared that the whole feature of the invention was the gas channelling. The authors had pointed out how serious was the limitation in the design of the cable which was imposed by the use of the gas channel. In fact they were seriously limited in their design by the maximum stress they might use and if any real progress was to be made in the continuous use of the high-voltage cable, stresses must be contemplated very much higher than those indicated in Table 3 of the paper. For that reason he did not think the cable, as at present designed, would survive the competition of other forms which were not subjected to this very severe limitation of ionisation stress.

Mentioning the authors' factor of safety of 2, Mr. Hunter said that if the factor of safety was properly chosen there should not be any electric discharge in the gas-filled gap. In criticising the paper he did not lack appreciation of the authors' achievements; he looked at the matter solely from the point of view of the best type for the future.

Mr. J. R. Beard (Merz & McLellan) said the paper showed that British cable makers still maintained the initiative which they had possessed since the Deptford first high-voltage cable. When the high-pressure gas-filled cable was first put forward, it was viewed by many with a great deal of doubt, but the experimental work which Mr. Beaver had done had largely resolved those doubts. With regard to the authors' suggestion of 254 kV between phases, what would be the dielectric loss at this voltage, and how would it affect the carrying capacity of the cable? Did the authors favour the use of lightning arrestors where their cables were connected to overhead lines.

Means of Reducing Cost

On the question of cost, Mr. Beard said that one would expect the gas-filled cable to be not unduly expensive and suggested means of reducing cost. For instance, three layers of metallised tape had not always been found necessary in the case of 66 kV; if the cable was working at low stresses would the omission of these matter? Again, the speed of lapping the paper on the cable was very much slower than with other types and this was also a reason for the high cost. Finally, he asked if the authors were prepared to operate a gas-filled cable at as high a temperature as an oil-filled cable.

Dr. P. Dunsheath (Henley's) suggested that many of the deductions in the paper would become valueless if it could be shown, as he believed it could, that their dependence on gap thickness had no foundation. The authors advocated the use of metallised paper, but it would have been useful to have had details of tests showing the results obtained with and without this. With such a complicated cable, sooner or later a little piece of metallised paper would be left poking out where it should not be; weaknesses of that kind were difficult to control. Personally he preferred a simple conductor carefully watched and made smooth. As regards the 5 per cent. distension which the authors suggested should be the figure at a

burst of a lead sheath, his experience had been that the amount of the distension was not a function of the quality of the lead but of the type of lead press used. Speaking generally, Dr. Dunsheath expressed the view that the development of the "supertension" cable could not be carried out in the laboratories of the manufacturers nor of the N.P.L. It was necessary for the user to co-operate and it had only been by the persuasive powers of Mr. Beaver that these cables had been tested under actual working conditions. If the C.E.B. had co-operated with other cable makers it was possible that this paper would have contained a description not of one such cable but of several. Working experience over two or three years was necessary with, say, four or five miles of cable.

Dr. J. L. Miller (British Insulated Cables) said there were other types of oil cables and gas-filled cables, and something more than a passing reference might have been made to these. It was clear that gas-filled cables of the type described by the authors would play an important part in future high-voltage schemes. With regard to the screening of the conductor, there had been much discussion in the journal of the American I.E.E. but there was a great difficulty in engineers making up their minds whether it was an advantage or not. The use of embossed or ribbed paper gave a slightly higher dielectric strength and also permitted permutivity grading, but that was not mentioned in the paper. On the question of impulses in high-voltage cables, he suggested that it would be easier to protect 200 kV or 300 kV lines than 132 kV lines, but that did not mean there would not be surges; therefore full dielectric strength must be provided by cable makers.

Oil-filled Cable Performance

Mr. R. E. Horley (Pirelli-General) said that whereas there were some 2,000 miles of oil-filled cables installed throughout the world, there were not more than 100 miles of gas-filled cable. The oil-filled cable had reached a very high standard for "supertension" work and gas-filled cables had something to live up to. His firm had made gas-filled cables with pre-impregnated paper and with mass impregnation, and the conclusion they had arrived at was that to fill a gas cable was a perfectly simple thing provided sufficient space was allowed for the gas. It was a simple matter to make a perfectly straightforward cable of this type.

Mr. G. N. Wright (London Power Co.) spoke of the possibility of corrosion of the reinforcing tapes and suggested either a non-corrodible material or a protective covering. Over-all armouring had great advantages and he pointed out that apparently the authors had made no arrangements for expansion.

Dr. L. J. Brazier (Callender's) pointed out that whereas the expenditure upon new generating plant since 1924 had been comparatively small (£80,000,000), having regard to the enormous increase in output, the increase in the cost of transmission systems was of the order of £250,000,000, and the paper would have served a good purpose if it stimulated the use of the gas-filled type of cable as a weapon to attack the high cost of transmission in this country.

Mr. T. R. Scott (Standard Telephones & Cables) recalled the lecture given by Emanuelli before the Institution some fifteen years ago on the performance of the 132-kV oil-filled cable and said the time was coming when there would have to be some sort of "show-down." In America they had debated the question of whether there should be screening of the conductors or not, but no final decision had been arrived at. Engineers, however, should not spend time on quibbling about such details; the fundamental question was what type of cable was most suitable and most economic for any given conditions of operation.

Suggested Sectionalisation

Mr. Bryan Donkin (Kennedy & Donkin) asked for amplification of the surge tests given in the paper and referring to the gas charge of this type of cable said it appeared that it was a matter of days rather than hours. This suggested the need for making each drum length a separate gas section.

Mr. J. K. Webb (Standard Telephones & Cables) asked why the idea of the use of ribbed paper had been dropped. Mr. Beaver replied that this development had been held up by the war. Mr. Webb, continuing, asked if there had been any trouble through the use of metallised paper. Semi-conducting carbon black paper might be used and should give less trouble as it was less liable to produce kinks in lapping.

Mr. Beaver, referring to the American gas-filled cable patents, said the original Fisher-Atkinson patents were owned by a certain company in the States, but that same company was now working under licence from his own company. That arrangement was made before the expiry of the Fisher-Atkinson patents.

Mr. Davey then replied to some of the points raised in the discussion, but the full reply will appear in the Institution *Journal*. He said that for general purposes he would prophesy that the gas-filled cable would eventually be cheaper than the solid type of cable, except for very short runs. As to higher stresses being required with the gas-filled cable to enable it to compete with other types, he said he saw no reason why higher stresses should not be used ultimately. There were dielectrics available which could be used at higher stresses.

COMMERCE and INDUSTRY

Engineers' Holiday Award. Torch Lamp Prices.

Electrical Machinery Control

UNDER the Machinery, Plant and Appliances (Control) (No. 4) Order, 1943 (S.R. & O. 1943 No. 536), which came into force on April 19th, the range of electrical machinery and plant previously licensable has been changed, mainly by restriction. Much of the matter thus decontrolled by the Board of Trade is licensable by the Minister of Supply under the Control of Industrial Electrical Equipment (No. 1) Order, 1943 (S.R. & O. 1943 No. 533), which came into force on the same date and was summarised in our last issue.

Purchase Tax Increase

In our last week's note on the Budget we mentioned that the classes of goods subject to the increase of Purchase Tax from 66⅔ per cent. to 100 per cent. included cut glassware lighting fittings, electric dry shavers and radiogramophones. We should also have mentioned hair-waving and hair-drying machines. According to a previous ruling of the Commissioners of Customs and Excise this term includes machines for both household and hairdressers' use, as well as heaters for hair-waving machines.

The Commissioners have issued a warning that the extra tax is not chargeable to the public on goods already acquired at the date of the Budget and dealers so imposing the extra charge will be liable to prosecution.

Power Engineers' Holidays

An award of the Industrial Court relating to holidays of technical staff in the electricity supply industry, generally speaking, re-affirms the holiday arrangements made for 1942. An employee who on April 1st had been in the continuous service of an undertaker for twelve months will be entitled to the same annual holiday as is customarily granted by the Undertaker, but not less than seven consecutive days' holiday with an addition of one day for each additional year of service in excess of twelve months, up to a maximum of fourteen days in all. An employee who leaves the service of an undertaker between November 1st and March 31st will be entitled to a holiday *pro rata*.

Flash Lamp Bulb Prices

The Board of Trade, after consultation with the Central Price Regulation Committee, has made an Order fixing the maximum price for flash lamp bulbs on sale to wholesalers, to retailers, and to the public. The Order covers all types of bulb designed for use in battery lamps and torches except those for police lamps, motor car lamps and radio sets. The retailers' margin will be 33⅓ per cent. on returns, excluding purchase tax; and the wholesalers' margin will be 20 per cent. on returns. The price to the public set out in the Schedule to the Order includes purchase tax. Prices have been divided into three groups according to the origin of the bulbs. The maximum retail price of the ordinary non-focusing bulb of 2·5 or 3·5 V and 0·2 or 0·3 A will be 5½d. if of American or Canadian origin, and 3½d. if of British manufacture. For bulbs imported from elsewhere the maximum retail price will be 3½d. each until June 30th in order to allow time for the disposal of stocks bought at high prices; but on and after July 1st, the maximum retail price will be 2½d. each.

The corresponding wholesale prices will be, for American or Canadian flash lamp bulbs, 25s. a hundred; for those of British manufacture, 16s. 8d. a hundred; and for those imported from elsewhere, 15s. 3d. a hundred until April 30th, and 11s. 1d. a hundred after that date. Where quantity discounts have been allowed on British produced bulbs by manufacturers or wholesalers to particular customers within the last three months, they will be required by the Order to continue this practice. The Order (S.R. & O. 1943 No. 247) will come into force on April 26th.

Standard Resistance Values

In our January 29th issue we reported that a measure of standardisation of fixed-composition resistances of all types except wire-wound had been decided upon, and that a chart showing how to apply the standard values was being prepared. We have now received a specimen chart from Erie Resistor, Ltd., Carlisle Road, The Hyde, London, N.W.9, showing the colour symbols and range in ohms together with the standard value which should be used. Copies of the chart (price 3d. post free) may be obtained from any manufacturer of fixed composition resistors by those on work of national importance.

Gauge and Tool Makers' Association

Over fifty firms have already joined the Gauge & Tool Makers' Association, which was formed in August last at the request of the Ministry of Supply to represent the interests of manufacturers of gauges and measuring equipment, jigs and fixtures and special tools, press tools, moulds and dies. The Association works in close touch with the Machine Tool Control and other Departments of the Ministry of Supply, Ministry of Aircraft Production, Admiralty, etc. The president of the Association is Mr. H. H. Harley, C.B.E. and the chairman is Mr. F. W. Halliwell. The secretary is Mr. G. T. Beach, Stanbrook House, Old Bond Street, W.1.

Flow Measurement

A recently issued standard code for flow measurement (B.S. 1042) should be useful to users of commercial flow meters and help to avoid disputes between makers and purchasers about the performance of prime movers, pumps and similar plant.

Conditions governing the design, installation and use of standard pressure-difference devices are fully set out in order to obtain consistent and generally acceptable results within a specified tolerance from commercial instruments. Flow meters are not dealt with, since adherence to the rules of the code enable the slight additional

tolerance required for any individual instrument to be easily established by a manometric check.

Volumetric measurement of fluid flow by weirs and notches is not included in the new code, which is available for 12s. 6d. post free, from the British Standards Institution, 28, Victoria Street, London, S.W.1.

Bombay Electrical Association

The Association of Electrical Undertakings in Bombay Province which was formed in 1940, held its second annual meeting recently, states the *Indian Textile Journal*. The annual report for the year ended August 31st last showed that four further companies were admitted to membership, making 30 in all. The year was marked by all-round increases in the cost of generation and distribution, due to the rise in fuel costs, A.R.P. expenditure, limitation of consumption on account of rationing, etc. With the object of curtailing demands for fuel oil the Government had imposed restrictions on the hours of operation of a number of supply companies and the report anticipated some extension of rationing supply in the near future. At the meeting Mr. V. F. Noel Paton, J.P., was elected president and Mr. P. E. Patel, A.Am.I.E.E., vice-president. The following were elected to the Council: Messrs. N. N. Adajania, S. J. W. Baldwin, A. L. Guildford, M.I.E.E., K. S. Guzder, F. J. Hecht, N. C. Javeri, J. B. Maneckji and E. A. Nadirshah.

Lighting a Radio Valve Works

The manufacture of radio valves with its intricate processes demands lighting of the finest quality. The accompanying illustration demonstrates how "Sieray" 80-W fluorescent tubes have been employed for this purpose with excellent results. In the section of the main assembly benches shown the work is relatively fine, and an intensity of 25 ft.-candles is provided. This is adequate for all normal operations, and the absence of both glare and hard shadows and the excellent quality of the lighting make it eminently suitable for work of this nature. The installation was designed by the Illuminating Engineering Department of Siemens Electric Lamps & Supplies, Ltd., and the electrical installation was carried out by the Northmet Power Co., Ltd., with Siemens equipment.

Fluorescent lighting is particularly suitable for the intricate work undertaken in a radio valve works

Foreign Capital in Portugal

The Lisbon correspondent of *The Times* reports that the Portuguese Government's decree providing for the control of the foreign capital in limited companies operating in Portugal became law on April 13th by publication in the *Diario de Governo*.

Electrical Year Book

In the 1943 edition of "The Electrical Year Book" (Emmott & Co., Ltd., *Mechanical World* Office, 78, Palatine Road, Manchester, and 28, Bedford Street, London, W.C.2, price 2s. 6d.) the section on dynamo and motor defects has been completely re-written so as to include, and be most applicable to, the types now commonly used. The sections on control gear and switchgear and switchboards have also been revised and further matter has been added to those on meters and measuring instruments, and speed control of AC motors.

F.B.I. and Post-war Plans

Speaking at the annual meeting of the Federation of British Industries last week, the retiring president (Lord Dudley Gordon) said that although it was undesirable to draw up inflexible plans for the post-war period it was necessary that we should not be caught unawares when the time came. There were some outstanding problems for the solution of which principles could be laid down. Members of the Federation demanded that such plans as were made should assume the continuance of individual enterprise. He did not, however, think that the Federation should advocate the immediate abandonment or even relaxation of the various wartime controls, for it was important that they should be maintained to prevent a repetition of the scramble for materials and finished goods which occurred after the last war.

The Federation had impressed upon Sir Kingsley Wood the need for providing industry with the financial means for the transition from war to peace, particularly in the case of businesses which had either been "concentrated" or closed down. Then there was the problem of finding the necessary finance for the conduct and development of future business. In future more attention should be given to industry's helping itself in this matter by "ploughing back" its own profits. Profits so dealt with should receive some relief from taxation. The F.B.I. had also advocated that any asset which dis-

appeared over the course of time should be written off against profits during its working life.

But the most pressing problem after the war would be export trade—not merely its resumption but its considerable increase. We could not exist without export trade, but export trade could not be reconstituted and increased without agreed arrangements with overseas countries. As the world's greatest customer we should make it clear that upon us and our purchasing ability the future prosperity of the world depended. In foreign trade, too, control of an international character would be necessary.

Appeal Dismissed

The Court of Appeal, consisting of the Master of the Rolls and Lords Justices MacKinnon and Goddard, last week dismissed the appeal of Mrs. Isabel Proctor, of West Street, Gravesend, claiming damages in respect of the death of her son, William James Proctor, against Johnson & Phillips, Ltd., of Charlton, who, Mr. Justice Hilbery found, were in no way liable. The dead man was a cable tester and he received a fatal electric shock at the works on June 24th, 1941.

The case for the appellant was that her son entered a high-voltage chamber and met his death owing to the automatic devices not operating. This the respondents denied, and pleaded that the fatality was due to the dead man failing to use the earthing rod he was provided with.

The Court upheld the contention of the respondents and came to the conclusion that had the dead man used the earthing rod, the accident would not have happened. The Court could not resist the conclusion that the dead man knew his duty was to use the earthing rod and that he took a risk in not using it. There was no breach of Regulation 4 by the respondents. They took every precaution for the safety of their workmen.

The appeal was dismissed with costs and leave to appeal to the House of Lords refused.

Reinstatement and Work

Mr. Justice Charles, with the concurrence of Mr. Justice Tucker and Mr. Justice Croom-Johnson, decided in the High Court on April 15th that the reinstatement of an employee under the terms of the Essential Work (General Provisions) Orders, 1942, did not necessarily mean that the employee must be given work.

The case was brought on the appeal of Mr. F. H. Hodge, of the Ministry of Labour and National Service, from a decision made by the Middlesex Justices in favour of Ultra Electric Co., Ltd. It appears that a Mrs. Dorothy Birch was engaged by the company in March last year. In the following May, having no work for her to do, the company, which was scheduled under the Essential Work Order, applied for permission to discharge her. Permission was given by a national service officer, but the local appeal board withdrew this permission and the company was directed by the national service officer to reinstate Mrs. Birch.

When Mrs. Birch attended the company's works there was still nothing for her to do and she was told that while the company would continue to pay her wages (£2 12s. 6d. a week) she could not remain on the premises. The company maintained (and the magistrates agreed) that this constituted the reinstatement of Mrs. Birch in its employment, but Mr. Hodge contended that compliance with the direction involved the provision of work.

In giving judgment, dismissing Mr. Hodge's appeal with costs, Mr. Justice Charles said that "reinstatement" in this matter connoted the restoration of the dismissed person to the position which he or she occupied before dismissal. He did not think that the giving of work was not to be considered, for "work" and "wages" were closely associated in the Orders. The company had done all that it could to give Mrs. Birch work and had not tried to evade its responsibilities or flout the direction of the national service officer. Thus by paying Mrs. Birch, although it had no work for her, the company had, in fact, reinstated her and the magistrates were right in dismissing the information.

Reinstatement Appeal

Switchgear & Cowans, Ltd., have lodged an appeal against a fine of £5 5s. for failing to reinstate a workman after the company had been directed to do so by the Ministry of Labour. The man was dismissed for misconduct and his appeal for reinstatement was upheld. On behalf of the company, it was stated that they were prepared to pay him £500 a year to keep away from the works because he had caused trouble.

Damages Award

Miss Gladys May Bibby, of Prescot, was awarded £2,175 damages and costs against British Insulated Cables, Ltd., at Liverpool Assizes on Friday. The action was the result of an accident whilst plaintiff was working a hydraulic press.

Trade Announcement

Engines & Electrics, Ltd., 3, St. James Square, Pall Mall, London, S.W.1, are now acting as agents in the London area for Edward Holme & Co. (1931), Ltd., for electric control gear equipment.

Changes of Name

The Trump Electrical Mat Co., Ltd., 18, Essex Street, W.C.2, has changed its name to Trump Electrical, Ltd.

The Telco Instrument Co., Ltd., 41, Gordon Square, W.C.1, has changed its name to Telco, Ltd.

Change of Address

Mr. H. G. Frampton, H.M. Electrical Inspector of Factories, has moved his offices to 30, Pembroke Road, Bristol, 8.

Prisoners of War Take I.E.E. Exams.

THANKS to the co-operation of the British Red Cross Society several British prisoners of war in Germany were enabled to take the associate membership examination of the Institution of Electrical Engineers last year. Five passed the whole examination, three Part I only and one Part II only. All the six successful candidates at the May examination were in Oflag 6B, while in the November examination two were in Stalag 22A and one in Stalag 8B. We understand that further papers from entrants are expected or await correction.

Factory Maintenance

Easing the Engineer's Burden

REPAIR and emergency work that maintenance engineers have to undertake in engineering works is the subject of a long paper prepared by Mr. J. Southern for the Association of Supervising Electrical Engineers in London.

The layout of a large composite factory composed of old and new multi-floor blocks as well as single-storey buildings scattered over a wide area, together with the sequence of manufacturing operations, are first referred to generally as having direct influence on maintenance. For instance, interior illumination by a few large lamps 20 ft. high may be advantageous in first cost, but it may take two men the best part of an hour to find a suitable ladder and replace a single lamp; whereas when many smaller fittings are mounted 10 ft. 6 in. high a lamp can be changed in a few minutes by one man with a step ladder.

The author also makes it clear that it is not possible to separate installation and maintenance of plant; a maintenance man of experience can save his employer hundreds of pounds annually in respect of alterations and the installation of additional equipment. Therefore staff must be carefully chosen and organised. The author deals with organisation in some detail, and in his outline of the method of tackling breakdowns indicates that a motor of 50 HP can be changed within an hour even when a half-mile walk is involved.

Built-in Motors

The breakdown of motors built into machines is not so easy to deal with. Machine tool manufacturers appear to the author to wrap their machine round its driving motor, so making it almost inaccessible; in addition, instead of orthodox feet, special fixing flanges are frequently provided, involving a good deal of improvisation. The maintenance engineer dreams of the day when all motors will be so standardised as to make them truly interchangeable.

Control gear replacement is simpler, as most machine tool manufacturers are content to incorporate the push button panel in the body of the machine, with the contactors separately accommodated. But American makers delight in burying all the control gear in the base of the machine, in the most inaccessible and dirty positions.

The natures of the various kinds of repairs that have to be undertaken are enumerated to indicate which kinds of equipment cause least trouble, provided inspection is made at regular intervals, and which are the more prolific sources of breakdown. The last-mentioned include ordinary industrial iron-clad switch-fuse gear in all sizes from 60 to 200 A, even those of reputable makes, while the 15- to 30-A sizes are mechanically too flimsy, most of the weaknesses being due to astonishing lack of foresight.

Fuses will continue to be a constant anxiety until some sort of a standard is reached. The high-rupturing-capacity type has gone a long way towards solving the problem, but it is not easy to be sure of having stocks of all sizes from 2 to 300 A on the spot at the precise moment they are needed, apart from the cost involved, so the author doubts whether the rewirable carrier will ever be replaced entirely; teak or lignum vitæ bridges have lasted for years under the most exacting conditions.

Low-voltage Operation

The author thinks that there should be no need to point out the advisability of operating all portable apparatus and tools at 110 V, obtained through step-down transformers from three-phase 420-V mains; this is neither difficult nor expensive. But the advent of fluorescent lighting has created a strong tendency to raise lighting circuits to 240 V throughout. That kind of illumination is for many purposes ideal to work under, but it is felt that before the tubes become really popular their depreciation factor will have to be improved and their shapes will have to be altered to enable them to be handled with less risk of breakage; in some situations it is almost impossible to replace them single handed.

Standard reflector fittings are suspended on stout chains, but the earthing is done through the three-core flexible connector. The author makes a further plea for all flexibles to be more positively distinguishable than by colour alone to make recognition of the earthing core easier in the dark, for instance, at ceiling roses, faults in which occur during darkness, and portable tool connectors which become very dirty.

Steel Specifications

A TABULATED summary of both British and American standard specifications for iron and steels, of which there is now a considerable number, has been issued as B.S. 1111 (12s. 6d. post free, from the British Standards Institution). It includes details of chemical composition and also mechanical properties of all British standard types, but is intended for reference only as it does not cover such essential requirements as tests.

ELECTRICITY SUPPLY

Views on Scottish Scheme.

Angus.—FARMERS AND THE HYDRO-ELECTRIC BILL.—Sir Herbert K. Ogilvy reported to the Public Health (Landward) Committee at Forfar recently on a meeting on the Hydro-Electric Bill that he had attended in Edinburgh. They knew, Sir Herbert stated, that electricity had not been supplied to farmers simply because the electricity company said it did not pay. They ought to have an opportunity of appeal, but the Secretary of State said he was afraid to put anything in the Bill which might upset the arrangements between the parties; he did not want anything contentious. But the new Board was to supply existing undertakings with electricity at cost price, and if the County Council felti t was not getting a fair deal it would have a strong case for bringing pressure to bear.

Sir Harry Hope said he was surprised that the Secretary of State did not wish to set up tribunals. The local M.P. should be approached to take the question up and secure the support of other M.P.s of agricultural constituencies. This was agreed to.

Arbroath.—PRICE REDUCTION SOUGHT.—The Town Council is asking the Secretary of State for Scotland "what provision, if any, he is making for the reduction of electricity charges in Arbroath in order that these might coincide with those in other towns." The town clerk said that the burgh had been suffering under a "peak" rate for electricity.

Brighouse.—SUBSTATION.—Sanction has been obtained by the Town Council to erect a substation costing £650.

HOSPITAL INSTALLATION.—Electrical installation work is to be carried out at a hospital at a cost of £535.

Cardiff.—ATTITUDE TO HIGHLANDS SCHEME.—The Rural District Council, at the suggestion of the National Industrial Development Council of Wales and Monmouthshire, has passed a resolution "viewing with anxiety the proposal to set up and finance a hydro-electric development plant in the Highlands of Scotland, with the obvious intention of attracting industry to that district." It was felt that the industrial development of Wales would be placed at a disadvantage and that existing industries would be menaced.

Huddersfield.—LOAN.—After considering the Corporation's application for sanction to borrow for mains and services, substations and equipment, the Electricity Commissioners have decided to limit their sanction to half the amount applied for.

London.—HOSPITAL LIGHTING.—The L.C.C. Health Committee has approved an estimate of £7,425 for the improvement of lighting in hospitals.

X-RAY EQUIPMENT.—A miniature mass radiography unit estimated to cost £3,350 and contact X-ray therapy apparatus costing £1,048 are to be purchased by the Health Committee.

LOANS.—Fulham Electricity Committee has received the Electricity Commissioners' sanction to borrow £4,500 to meet the balance of expenditure on substations. Application is being made for permission to borrow £1,200 for protective fencing at the power station and £7,174 for an alternative water supply.

Grants for Rural Supplies?

Montrose.—MOVE FOR INCLUSION IN HYDRO-ELECTRIC SCHEME.—The Town Council at its last meeting accepted in principle a motion that the necessary steps should be taken to secure the inclusion of the town in the area covered by the Hydro-Electric Development Bill.

North Wales.—NEW SUPPLIES TO FARMS.—At the quarterly meeting of the North Wales and South Cheshire Joint Electricity Board at Llandudno, Mr. J. Rankin (North Wales Power Co., Ltd.) reported that there had been many applications for electricity supplies to farms which his company would be prepared to meet. The problem of capital expenditure was the obstacle.

Mr. Price F. White, Bangor, proposed that the Ministry of Agriculture should be asked to make grants in cases where it could be shown that electricity would be of assistance in food production. It was agreed that a resolution on these lines should be sent to the Ministry.

Salford.—METERS.—The Town Council is recommended to make application for sanction to borrow £1,000 for electricity meters during the year ending March, 1944.

Wembley.—EXTENSION OF PURCHASE DATE.—The Electricity Commissioners have made an Order extending for three years the period (ending June 24th, 1944) after the expiry of which the Corporation may purchase the undertaking authorised by the Kingsbury Electric Lighting Order, 1905, from the Northmet Power Co.

Whitley Bay.—SUBSTATION.—The Urban District Council has approved plans for the erection of a substation by the North-Eastern Electric Supply Co., Ltd.

TRANSPORT

London.—RECOVERY OF TRAM RAILS.—It was reported to the Hackney Borough Council last Saturday that all tramway tracks in the borough except a short length in Lea Bridge Road had now been removed. The value of steel disposed of to the end of January was £49,038.

Newcastle-on-Tyne.—APPLICATION FOR EXTENSION OF ORDER.—The City Transport and Electricity Committee has agreed to apply to the Ministry of War Transport for an extension of three years from December 31st, 1943, of the Order authorising the Committee to introduce trolley-buses over the High Level and Tyne Bridges into Gateshead. The matter is being considered by the Gateshead and Felling Councils which are involved in the decision.

South Shields.—LOAN OF TROLLEY-BUSES.—Owing to a number of its own vehicles being laid up for repairs, the Corporation is to borrow three trolley-buses from Bournemouth Corporation for a period of three months.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Enfield Cable Works, Ltd.—In a statement circulated with the report and accounts the Earl of Verulam (chairman) says that the gradual reorganisation of plant, buildings and equipment at the company's several factories, begun in 1941, continues. There is a steady improvement to report, with more efficient layouts and better working conditions.

Considerable variation is shown in the figures of this year's accounts when compared with those of the last two years. Among the several reasons for this stands out the problem of how to produce a rubber-insulated cable without crude rubber. The invasion of Malaya by the Japanese has meant a drastic curtailment in the quantity of crude rubber available, even for the most urgent Government orders.

The reduction of profit to £182,621, against £240,179 last year, is not wholly accounted for by the reduced output. The wartime demand has been for the smaller types of cable on the sale of which in general the margin of profit is low. The Brimsdown Rubber Co. had a reasonably good year, as did also the Australasian Enfield Co.

Enfield Rolling Mills, Ltd.—The report for 1942 shows that the net profit rose from £12,062 to £24,062 after meeting all charges. The dividend is maintained at 2½ per cent., and £111,884 is carried forward, compared with £94,822 brought in. Owing to the company's initial difficulties in the standard years for excess profits tax, a choice has to be made between dividend and reasonable maintenance of the capital assets. It is hoped that it may be possible in the future to raise the dividend to a 5 per cent. basis. At the annual meeting on May 14th a resolution will be considered to convert the issued shares of the company into stock.

A. Reyrolle & Co., Ltd., held their annual meeting on April 15th. Mr. Norbert Merz (chairman), who presided, praised the work of the staff and workpeople during the past year and mentioned that a joint consultative and advisory committee had been formed for the co-operative solution of problems. The expenditure for development purposes had been increased. Continuous research to effect improvements in production, particularly in the saving of materials, would involve heavy expenditure on new designs when these could be produced. Additional provision had also been made for renewals which might be necessary as a result of the increased wear and tear of equipment through continuous working.

Hall Telephone Accessories (1928), Ltd., held its annual meeting on April 15th, when Major the Hon. Oscar M. Guest, M.P. (chairman) presided. In a statement circulated with the report and accounts the chairman referred to the Excess Profits Tax. He said that once more the company showed an increased turnover, which was one indication of its contribution to the war effort. Another was the increased size of the taxation reserve, for as the company's earnings exceeded its E.P.T. standards all profits above that limit belonged to the Exchequer. Unfortunately, as the chairmen of so many public companies had pointed out, it was not possible to get relief from taxation for the capital expenditure which few could avoid and therefore any such expenditure, however desirable, diminished liquid assets. As he had pointed out last year, although the company's increased activity helped the nation, yet it could not increase the amount earned for the shareholders in present conditions.

With regard to the accounts, he said that the sum of £25,000 had been placed to general reserve, but an equal sum had been transferred from the general reserve and applied in writing down goodwill by £5,000 and plant, machinery, fixtures, and fittings by £20,000.

The Telephone & General Trust, Ltd., reports revenue for 1942 amounting to £152,336, as compared with £155,154 in 1941. The net profit, after provision of £6,721 (£10,000) for taxation was £97,605 (£97,962). After paying the preference dividend for the year a final distribution of 5 per cent. is made on the ordinary capital, making 8 per cent. and a first and final dividend of 8 per cent. on the "A" ordinary capital. A sum of £70,443 is carried forward as compared with £69,498 brought in. Valuation of investments is 2·21 per cent. above the balance-sheet figure of £2,677,384 (against a depreciation of 2·88 per cent. a year previously).

In a statement circulated with the report Sir Alexander Roger, chairman and managing director, says that if, as he thinks, it will be necessary for industry generally to export largely to maintain the social services and standard of living of Great Britain, we must consider whether industry will be able to load the price of our goods with additional costs and still sell successfully and in sufficient quantity or whether industry must reduce its export prices to be on a competitive basis with other, less advanced, countries.

The Telegraph Condenser Co., Ltd., is to maintain the dividend on its ordinary shares at 5 per cent. After paying E.P.T. but before providing for income tax the profits on trading amounted to £66,490 for the year ended December 31st as compared with £67,301 in the preceding year. After allowing for special receipt of £2,038 (nil), depreciation £10,549 (£10,563), directors' fees £1,406 (£1,719), income tax £35,100 (£34,564) there is a carry forward of £38,639 (£24,816).

The Canadian General Electric Co., Ltd., reports a net profit for the year ended December 31st, 1942, of $2,327,452 against $2,479,555 in 1941. After paying preferred dividends this is equal to $11·71 per common share ($12·57 in 1941). Mr. D. C. Durland, chairman and president, states that the volume of orders received and production were the largest in the company's history and substantially greater than in 1941, the previous record year. Last year marked the fiftieth anniversary of the foundation of the company.

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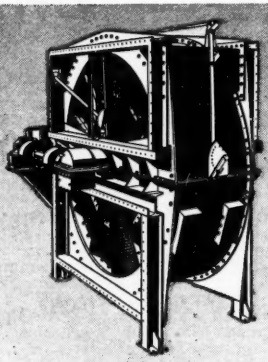

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Elektrolux (Stockholm) reports a net profit for 1942 of 3,445,079 kr., after setting aside 1,900,000 kr. for Swedish taxes; in 1941 the profit was 3,258,724 kr. It is proposed to pay a dividend of 5 kr. per 75 kr. share, as last year. After allocating 100,000 kr. (same) to the pension fund a sum of 17,354,333 kr. is carried forward (against 16,909,254 kr.).

Laurence, Scott & Electromotors, Ltd., report a net profit of £108,202, after charging excess profits tax (against £96,856). The dividends on the "A" and "B" ordinary shares are again 12½ per cent. (7½d. per share).

Ever Ready Trust, Ltd.—From a net revenue of £28,893 (£28,845) a final dividend of 6 per cent. is being paid on the ordinary and deferred shares, again making 9 per cent. for the year. The net assets, at book value, amounted to £400,656, representing an excess of 34 per cent. over the issued capital.

The Electric Supply Corporation, Ltd., announces that its net revenue for 1942 amounted to £57,482 (against £59,492). The dividend on the ordinary stock remains at 10 per cent.

Sangamo Weston, Ltd., reports that after meeting taxation and putting £4,000 to deferred repairs reserve, the profit for 1942 was £35,494, as compared with £21,308 for 1941, when £30,000 was placed to war contingencies reserve. A dividend of 15 per cent. for the year is again recommended.

Ransomes & Rapier, Ltd., reports a net profit for 1942 of £26,008, compared with £19,938 in 1941. The final ordinary dividend is increased from 3 to 4 per cent. free of tax, making 6 per cent. (against 5 per cent.) free of tax for the year.

The India Rubber, Gutta Percha & Telegraph Works, Ltd., is paying a fixed dividend of 6 per cent. on its ordinary shares and an additional 3 per cent., making 9 per cent. for 1942 (nil in 1941).

The Southern Areas Electric Corporation, Ltd., is again making a first and final distribution of 5 per cent. on the ordinary shares for 1942.

Companies' Returns

Statements of Capital

Artic Fuse & Electrical Manufacturing Co., Ltd.—Capital, £5,000 in 4,700 ordinary and 100 deferred ordinary shares of £1 and 4,000 founders' shares of 1s. Return dated December 31st, 1942 (filed March 29th, 1943). 3,433 ordinary, 100 deferred ordinary and 2,590 founders' shares taken up. £2,329 13s. paid on 2,233 ordinary and 1,933 founders' shares. £1,332 17s. considered as paid on 1,200 ordinary 100 deferred ordinary and 657 founders' shares. Mortgages and charges: Nil.

Milton & Barton-on-Sea (Hants) Electricity Supply Co., Ltd.—Capital, £25,000 in 5,000 7½ per cent. cumulative preference and 20,000 ordinary shares of £1. Return dated April 14th, 1942 (filed October 19th). All shares taken up. £24,227 paid on 5,000 preference and 19,227 ordinary shares. £773 considered as paid on 773 ordinary shares. Mortgages and charges: Nil.

John Dugdill & Co., Ltd.—Capital, £10,000 in 10,000 shares of £1 each. Return dated November 16th. All shares taken up. £3 paid. £9,997 considered as paid. Mortgages and charges: Nil.

Thomasson & Co. (Shrewsbury), Ltd.—Capital £1,000 in 1,000 shares of £1 each. Return dated September 11th (filed October 6th). 769 shares taken up. £769 paid. Mortgages and charges: £3,328.

Colombo Electric Tramways & Lighting Co., Ltd.—Capital, £150,000 in £10 shares. Return dated October 6th. 13,084 shares taken up. £840 paid. £130,000 considered as paid. Mortgages and charges: Nil.

Simplex Conduits, Ltd.—Capital, £100,000 in £1 shares. Return dated November 9th. 90,000 shares taken up. £50,000 paid. £40,000 considered as paid. Mortgages and charges: Nil.

Mortgages and Charges

J. Warsop & Co., Ltd.—Satisfaction to the extent of £776 on March 25th of debenture dated June 15th, 1938, and registered June 30th, 1938, securing £1,000.

Receivers Appointed and Released

Block Batteries, Ltd.—John O. Blyth, 4, Broad Street Place, E.C.2, was appointed receiver and manager on March 8th, under powers contained in debentures dated June 29th, 1934, and July 9th, 1934.

J. Warsop & Co., Ltd.—A. C. D. Kingston, 16, Millmead Terrace, Guildford, ceased to act as receiver and manager on April 5th.

Bankruptcies

F. W. Hodges, electrical engineer, 9a, Station Hill, Kidderminster.—An application for discharge was heard recently at the Town Hall, Kidderminster. It was stated that the bankruptcy occurred in 1930, and the liabilities amounted then to £555. The assets had produced £441, and a dividend of 11s. 6½d. in the £ had been paid to the creditors. Debtor was reported to have been discharged from the Royal Navy in 1926 through defective eyesight, and he then commenced in business. He was now serving again in the Royal Navy. The Judge said that there were no discreditable features in the bankruptcy, and he granted the discharge, subject to three months' suspension.

H. J. Fowlie, electrical engineer, 40, Queen Street, Maidenhead.—Proofs for dividends by May 3rd to the trustee, Mr. J. B. Simmons, Official Receiver, 8, Forbury, Reading.

R. M. Jones, radio dealer, 40, Lordship Lane, East Dulwich, London, S.E.22.—Supplemental dividend of 2s. 3d. payable at Bankruptcy Buildings, Carey Street, London, W.C.2.

G. C. Spong and J. H. Trussell ("C.C.S. Trading Co."), electricians, 30, Western Mail Chambers, Cardiff (separate estate of G. C. Spong).—First and final dividend of 13s. 5d. payable May 7th at the Official Receiver's Office, 34, Park Place, Cardiff.

STOCKS AND SHARES

TUESDAY EVENING.

THE effect of the Budget can be said to have worn off. Actually, it made little difference to any of the Stock Exchange markets. People seem pleased to think that they were let off without more serious burdens being imposed upon them; and, for this reason, Stock Exchange prices improved in various departments. The high-priced industrial shares had hardly been affected in advance of the Budget, but removal of the suspense that always precedes the Chancellor's statement produced a feeling of relief, and prices, where they moved at all, were mostly better. Business certainly improved, and the most gigantic Budget with which this country has ever been faced exercised no unfavourable effect upon security quotations.

Home Railways Rise

The Home Railway market has taken on a brighter appearance. The junior stocks more particularly have aroused renewed favour, with a consequent improvement in prices, the senior stocks being somewhat neglected for the time being. Gilt-edged securities as a whole are in the background, there being no special reason for buyers to come forward and take the stocks at to-day's high prices. The lower-grade Home Railway issues have as their principal attraction an excellent yield to offer, although London Passenger Transport "C" stock, which has been prominently good during the past few days, gives no more than £5 1s. 6d. per cent. return on the current advanced figure of 61. Hopes of increased dividend are confidently expressed. Southern Railway preferred recovered to 75¼ after being down to 74. The markets for Home Railway stocks as a whole are more active.

Home Electricity Supply

While the share prices in the Home electricity supply group give no evidence of a change in the investor's outlook upon the industry, the fact remains that a firmer disposition has become manifest. Selling is less insistent and the fall in the prices has been stayed. A few buyers are looking round for cheap stock. County of London ordinary, which proved the most vulnerable of the Metropolitan shares, have steadied at 38s. 6d. Before the London & Home Counties J.E.A. published its proposals the majority of ordinary shares in the Home electricity supply market stood at prices that afforded a yield of about £3 17s. 6d. per cent. on the money. It is interesting to look at to-day's yields: they are mostly a little over 4 per cent. Yorkshire ordinary and Clyde Valleys yield the round 4 per cent. and Northmets no more than 3¾ per cent. But the majority of the others pay just above the level rate. West Devons are 6d. up, at 23s. 6d. North Easterns and Midland Electric Power have lost a similar amount.

Equipment and Manufacturing

Electric Construction stand out with a rise of 1s. 6d. to 44s. and gains of 1/6 are marked in British Insulated, Ensign Lamps, Lancashire Dynamo, Thorn Electric and Mather & Platt. The demand for such shares exceeds the supply: the principal sources of the latter—somewhat grim as it may seem to say so—are deceased accounts. Small improvements have occurred in British Aluminium and in Telephone Manufacturing. There has been steady demand for Switchgear & Cowans. The dividend, recently doubled at 20 per cent., allows an income of £6 13s. 4d. per cent. at 15s. for these 5s. shares. Strand Electrics at 6s. 6d. are 3d. lower. Telegraph Condenser 10s. ordinary are unchanged at 15s. upon repetition of the previous dividend of 5 per cent. for the year. While cable manufacturing shares hold their ground, Cable & Wireless preference and ordinary stocks show declines at 114½ and 75½, respectively.

Brazilian Tractions

The increased dividend on Brazilian Traction shares, mentioned here last week, produced a wave of speculative investment that carried up the price to 28½, a rise of four dollars in a fortnight. South and Central American stocks are regaining popularity. Mexican Light & Power Firsts, at 101½, have advanced 1½, and other Mexican issues are better on the week. Interest in Anglo-Argentine Trams has subsided. Canadian utility dollar stocks present no features of importance. Canadian Marconis are 6d. easier after their recent rise.

Requisition Rumours

What is called the Short Brothers incident continues to engage notice in Parliament and out of it. The Government has taken over the shares in the company at a price to be fixed by the Treasury, presumably on the basis of the willing buyer meeting the willing seller. The transaction closely affects a much wider interest than that of the shareholders in this company or other undertakings which are connected with aircraft work. Nervous proprietors of commercial and industrial companies' shares are asking whether there is any likelihood of their being called upon to hand over their stocks and shares at the instance of the Government. Fantastic as this fear may seem, it finds expression in various directions. However, only the highly apprehensive need

(*Continued on page* 566)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price April 20	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	58/-	..	4 6 2
British Power and Light	6	7	31/-	..	4 10 4
City of London	7	7	30/-	..	4 13 4
Clyde Valley	8	8	40/-	..*	4 0 0
County of London	8	8	38/-	..	4 4 3
Edmundson's:					
7% Pref.	7	7	34/-	..	4 2 4
Ord.	6	6	29/-	..	4 2 9
Elec.Dis.Yorkshire	9	9	44/6	..	4 1 0
Elec. Fin. and Securities	12½	12½	51/-	..	4 18 1
Elec. Supply Corporation	10	10	47/-	..	4 5 0
Isle of Thanet	2	Nil	16/-	..	—
Lancs. Light and Power	7½	7½	35/-	..	4 5 9
Llanelly Elec.	5½	6	26/-	..	4 12 4
Lond.Assoc.Electric	4	3	21/-	..	2 17 2
London Electric	6	6	26/6	..	4 10 7
London Power Red. Deb.	5	5	104½	..	4 15 7
Metropolitan E.S.	8	8	38/6	..	4 3 2
Midland Counties	8	8	39/-	..	4 2 1
Mid. Elec. Power	9	9	43/-	−6d.	4 3 9
Newcastle Elec.	7	7	31/-	..	4 10 5
North Eastern Elec. Ordinary	7	7	32/-	−6d.	4 7 6
7% Pref.	7	7	35/6	..	2 19 0
Northampton	10	10	47/6	..	4 4 0
Notting Hill 6% Pref. (£10)	6	Nil	9¾	..	—
Northmet Power:					
Ordinary	7	7	37/-	..	3 15 8
6% Pref.	6	6	31/6	..	3 16 2
Richmond Elec.	6	6	26/-	..	4 12 4
Scottish Power	8	8	39/-	..	4 2 0
Southern Areas	5	5	23/6	..	4 5 0
South London	7	7	26/-	..	5 7 8
West Devon	5	5	23/6	+6d.	4 5 0
West Glos.	4½	3½	23/-	..	3 0 10
Yorkshire Elec.	8	8	40/-	..	4 0 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	4/9	..	—
Calcutta Elec.	7*	7*	34/6	..	—
Cawnpore Elec.	10	10	30/-	..	6 13 4
East African Power	7	7	32/-	..	4 7 6
Jerusalem Elec.	7	5	25/6	+6d.	3 18 5
Kalgoorlie (10/-)	7½	5	9/-	..	5 11 1
Madras Elec.	6*	4*	24/-	..	—
Montreal Power	1½	1½	27½	..	5 7 2
PalestineElec."A"	Nil	4*	39/-	..	2 2 1
Perak Hydro-elec.	6	7	9/-	..	—
Shawinigan Power	83cts.	90cts.	19	..	—
Tokyo Elec. 6%	6	6	19	..	—
VictoriaFallsPower	15	15	4	..	3 15 0
WhitehallInv.Pref.	—	—	24/-	..	—

Company	Dividend Previous	Dividend Last	Middle Price April 20	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1955–60 (Civil Defence)	—	3	100	..	3 0 0
1955–75	5	5	115	..	4 7 0
1951–73	4¼	4¼	109	..	4 2 7
1963–93	3½	3½	104½	..	3 7 0
1974–94	3¼	3¼	101	..	3 3 9
LondonElec.Trans. Ltd.	2½	2½	96½	..	2 11 10
London & Home Counties 1955–75	4½	4½	111	..	4 1 1
Lond.Pass.Trans.:					
A	4½	4½	122½	..	3 13 6
B	5	5	120½	..	4 3 0
C	2⅞	3	61½	+2	4 17 7
WestMidlandsJ.E.A. 1948–68	5	5	110	..	4 11 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	113½	..	5 5 9
Def.	1½	1½	28	..	5 7 2
Anglo-Portuguese	8	8	24/-	..	6 13 4
Cable & Wireless:					
5½ Pref.	5½	5½	114½	−1	4 16 1
Ord.	4	4	75½	−½	5 6 0
CanadianMarconi$1	Nil	4cts.	7/6	−6d.	—
Globe Tel. & Tel.:					
Ord.	8¼*	5*	35/-	..	2 17 2
Pref.	6	6	28/6	..	4 4 3
GreatNorthernTel.: (£10)	Nil	Nil	23½	..	—
Inter. Tel. & Tel.	Nil	Nil	11	..	—
Marconi-Marine	7½	7½	33/-	..	4 11 0
Oriental Tel. Ord.	16	10	37/-	..	—
Telephone Props.	6	Nil	14/-	..	—
Tele. Rentals (5/-)	10	10	10/9	..	4 13 0
Traction and Transport					
Anglo-Arg. Trans.:					
First Pref. (£5)	Nil	Nil	5/-	..	—
4% Inc.	Nil	Nil	13	..	—
Brit.Elec.Traction:					
Def. Ord.	45	45	1045	..	4 6 4
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8	10	51/-	..	3 18 6
Brazil Traction	$1½	$1	28½	+1⅛	—
Calcutta Trams	8	5½	25/-	−⅛	4 8 0
Cape Elec. Trams	5	6	25/-	..	4 16 0
Lancs. Transport	10	10	43/3	..	4 12 4
Mexican Light:					
1st Bonds	5	5	101½	+1½	4 18 6
Rio 5% Bonds	5	5	104½	..	4 15 9
Southern Rly.:					
5% Prefd.	5	5	73½	+½	6 16 0
5% Pref.	5	5	117	..	4 5 6
T. Tilling	10	10	53/3	..	3 14 5
West Riding	10	10	42/-	..	4 15 3

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price April 20	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord...	7½	10	40/–	..	5 0 0
Assoc. Elec.:					
Ord.	10	10	50/–	..	4 0 0
Pref.	8	8	40/–	..	4 0 0
AutomaticTel.&Tel.	12½	12½	58/–	..	4 6 2
Babcock & Wilcox	11	11	51/3	+3d.	4 5 9
British Aluminium	10	10	50/–	+9d.	4 0 0
British Insul. Ord.	20	20	5⅛	+⅛	3 17 3
British Thermostat (5/–)	18½	18½	17/6	..	5 5 9
BritishVac.Cleaner (5/–)	10	15	24/3	..	3 1 10
Brush Ord. (5/–)	Nil	6	7/9	..	3 17 5
Burco (5/–) ..	15	15	14/3	..	5 5 1
Callender's ..	15	15	4⅛	..	3 14 0
ChlorideElec.Storage	15	15	78/3	..	3 16 9
Cole, E. K. (5/–)	7	10	21/3	..	2 7 0
Consolidated Signal	17	24	5⅞	..	4 8 3
Cossor, A. C. (5/–)	15	10*	22/–	+1/6	3 6 8
Crabtree (10/–) ..	17½	17½	37/6	..	4 13 4
Crompton Parkinson Ord. (5/–) ..	30	20	25/–	–1/–	4 0 0
E.M.I. (10/–) ..	6	6	24/–	..	2 10 0
Elec. Construction	10	10	24/–	+1/6	4 11 0
Enfield Cable Ord.	12½	12½	57/–	..	4 7 9
Elecl. Switchgear (10/–)	10	10	20/–	..	5 0 0
English Electric	10	10	48/–	¼·	4 3 4
Ensign Lamps(5/–)	25	25	21/3	+⅛	5 17 8
Ericsson Tel. (5/–)	22†	20†	47/6	..	2 2 2
Ever Ready (5/–)	40	40	38/6	..	5 4 0
Falk Stadelmann	7½	7½	30/6	..	4 18 4
Ferranti Pref. ..	7	7	28/9	..	4 17 5
G.E.C.: Pref. ..	6½	6½	34/3	..	3 16 0
,, Ord. ..	20	17½	89/–	..	3 18 8
Greenwood&Batley	15	15	38/–	..	8 0 0
HallTelephone(10/–)	12½	12½	25/9	..	4 17 0
Henley's (5/–) ..	20	20	25/6	..	3 18 6
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	15	57/3	..	5 4 5
India Rubber Pref.	5½	5½	20/–	..	5 10 0
Intl. Combustion	30	30	6½	..	4 17 10
Johnson & Phillips	15	15	68/–	..	4 8 3
LancashireDynamo	20	22½	88/9	+⅛	5 1 5
Laurence,Scott(5/–)	15	12½	12/–	..	5 4 2
London Elec.Wire	7½	7½	31/6	..	4 15 3
Mather & Platt	10	10	50/–	+⅛	4 0 0
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	5⅞	..	3 13 6
Pye Deferred (5/–)	25	25	21/3	..	5 17 8
Revo (10/–) ..	20	17½	35/–	..	5 0 0
Reyrolle ..	12½	12½	65/9	..	3 16 0
Siemens Ord. ..	7½	7½	30/3	..	4 19 2
Strand Elec. (5/–)	4	7½	6/6	–3d.	5 15 5
Switchgear & Cowans (5/–) ..	10	20	15/–	..	6 13 4
T.C.C. (10/–) ..	5	5	15/–	..	3 6 8
T.C. & M. ..	10	10	47/–	..	4 5 1
TelephoneMfg.(5/–)	9	9	12/–	+6d.	3 15 0
Thorn Elec. (5/–)	20	20	21/3	+⅛	4 14 1
Tube Investments	23¾	20	93/6	..	4 5 6
Vactric (5/–) ..	Nil	Nil	13/3	–3d.	—
Vickers (10/–) ..	10	10	20/9	..	4 16 5
WalsallCondnits(4/–)	55	55	45/–	..	4 17 9
Ward & Goldstone (5/–)	20	20	22/6	..	4 9 0
WestinghouseBrake	10	12½	63/6	..	3 18 9
West, Allen (5/–)	7½	7½	6/9	..	5 11 2

* 5 per cent. tax-free.

† Dividends free of Income Tax.

Stocks and Shares (*Continued from page* 564)

fear any such possibility in connection with companies that are not very intimately associated with war work.

The Cossor Boomlet

Wireless and radio shares have once more attracted energy and capital alike during the past week. The principal feature has been a sharp rise in A. C. Cossor shares, where the price was carried up to 22s. 6d. before drooping to 22s. The latter amount shows a rise of 1s. 6d. Expectation is on tiptoe for official notification of the company with which Cossor is said to be going to amalgamate. The strength of Cossors finds reflection in the interest taken in other wireless and radio issues, of which Philco, E.M.I. and Scophony are three examples. People are looking forward to the end of the war and justifying purchases of shares in these companies by referring to the unlimited scope for work and enterprise that will be open when the business returns to peacetime operations. Pye deferred shares, it may be noted, have moved but little of late. The present-paid dividend of 25 per cent. provides a yield of £5 17s. 8d. per cent. on these 5s. shares at the current price of 21s. 3d. E. K. Cole 5s. shares stand at 21s. 3d. and the yield is a frugal £2 7s. per cent. on the dividend last paid.

Telephone & General

At the general meeting of the Telephone & General Trust to be held on Wednesday in this week Sir Alexander Roger, chairman and managing director, will reiterate his statement outlining the company's progress during the past year and, incidentally, will read an interesting homily on such questions as capitalisation and distribution of wealth. "A prodigious change has come over Great Britain since the war" declares Sir Alexander Roger; "the startling fact is we have become a veritable democracy of capitalists. Some 16,000,000 people in this country own War Savings certificates alone. The number of income-tax payers has risen from 3,800,000, in 1938-9, to 10½ millions now. The weekly wage-earner bears a share of direct taxation for the first time in history." The statement deserves reading in full as a contribution to the conclusions that can be drawn from present-day conditions and a wartime Budget.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AKT.-GES. Brown, Boveri & Cie.—"Steam turbine regulating systems." 2855/42. March 4th, 1941. (552279.)

J. Belitsky.—"Means for connecting an electric welding circuit to a workpiece." 12711. October 1st, 1941. (552378.)

Briggs Manufacturing Co.—"Electric welding apparatus." 7933/41. January 4th, 1941. (552366.)

British Insulated Cables, Ltd., and J. C. Quayle.—"Electric cables." 15283. November 27th, 1941. (552273.)

British Thomson-Houston Co., Ltd.—"Automatic regulating apparatus for alternating-current electric circuits." 15916/41. December 11th, 1940. (552274.) "Synthetic resins." 6613/41. May 24th, 1940. (552313.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—"Thermo-setting aminotriazine-formaldehyde condensation products." 13366. October 17th, 1941. (552270.)

F. E. Burt and Rely-a-Bell Burglar & Fire Alarm Co., Ltd.—"Electric heaters chiefly designed for use in drying cabinets." 15043. November 21st, 1941. (552338.)

Cinema-Television, Ltd., and T. C. Nuttall.—"Trigger circuits employing thermionic valves." 12608. September 29th, 1941. (552301.)

G. E. M. Corin and N. Ericsson.—"An electrical arrangement for recording sound." 8222. June 30th, 1941. (Convention date not granted.) (552315.)

English Electric Co., Ltd., and J. E. Calverley.—"Commutator type dynamo-electric machines." 16212. December 16th, 1941. (552332.)

English Electric Co., Ltd., G. Tilstone and T. A. Eccles.—"Means of mounting a rotary magnet on its spindle." 14761. November 17th, 1941. (552337.)

Ferranti, Ltd., E. S. Cluderay and J. Dean.—"Fluid-pressure responsive devices." 11027 and 11028. August 29th, 1941. (552293 and 552294.)

W. T. Henley's Telegraph Works Co., Ltd., and P. Dunsheath.—"Machine for the continuous production of strips of paper for use as insulating material in an electric cable or cable joint." 1331/43. August 23rd, 1941. (Divided out of 10780/41.) (552308.)

Marconi's Wireless Telegraph Co., Ltd.—"Television transmission." 16570/41. December 24th, 1940. (552276.)

Maschinenfabrik Oerlikon.—"Thermally released electric circuit-breakers." 9519/42. July 16th, 1941. (552383.)

Philips Lamps, Ltd. (Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—"Circuit arrangements for synchronising an oscillation generated by a generator in the correct phase." 9658. July 29th, 1941. (552317.)

Reslo (Sound Equipment), Ltd., and L. W. Murkham.—"Loudspeakers and the like." 15642. December 4th, 1941. (552328.)

Standard Telephones & Cables, Ltd.—"Piezo-electric crystal apparatus." 4159/42. November 16th, 1940. (552355.)

Standard Telephones & Cables, Ltd., and E. O. Willoughby.—"Radio altimeters." 12500. September 26th, 1941. (552260.)

C. A. Turner and Diamond H. Switches, Ltd.—"Rotary electric switches." 12645. September 30th, 1941. (552375.)

E. J. W. Watkinson.—"Remote-control devices, *e.g.*, for X-ray tube control." 12556. September 27th, 1941. (552297.)

Western Electric Co., Inc.—"Thermionic amplifiers." 16139/41. December 24th, 1940. (552331.)

Westinghouse Brake & Signal Co., Ltd., L. H. Peter and J. P. Coley.—"Block signalling systems for railways and the like." 8973. May 29th, 1940. (552310.)

Amended Specification

535702. Standard Telephones & Cables, Ltd. "Automatic charging of secondary batteries."

TRADE MARK APPLICATIONS

THE following applications have been received for British trade marks. Objections may be entered within a month from April 14th :—

ASTRA. No. 622,292, Class 9. Electric switches.—Astra Pharos, Ltd., Landor Walk, Askew Road, Shepherd's Bush, London, W.12.

COOPER STEWART (design). No. 619,775, Class 9. Speedometers, tachometers, ammeters and liquid level indicators. — Cooper-Stewart Engineering Co., Ltd., Stewart House, 136-137, Long Acre, London, W.C.2.

ASCO. No. 621,736, Class 11. Installations for cooking, refrigerating, drying and ventilating. —Automatic Scale Co., Ltd., Timperley Works, Manchester Road, Broadheath, Altrincham.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

Paterson, Cooper & Co.—generator makers.

MATCHLESS electric kettle.

Name wanted of makers of porcelain battery containers in Horwich, Lancs.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Glasgow.—April 30th. Lighting Department. Supply of electrical fittings, etc., from June 1st to November 30th, 1943. Specifications and forms from the Lighting Department, 20, Trongate; tenders to Town Clerk.

Orders Placed

Glasgow.—Corporation Transport Committee. Accepted. Trolley wire.—Whitecross Co. Field coils.—Oldfield Engineering Co. Tubing for bow collectors.—Tubes, Ltd.; Accles & Pollock; Potter, Cowan & Co.

Hebburn-on-Tyne.—Urban District Council. Accepted. Electrical repairs to council houses.—W. Scott; H. Warburton.

Lichfield.—Electricity Committee. Accepted. Switchgear.—Ferguson, Pailin. Two transformers.—British Electric Transformer Co.

Newcastle-on-Tyne.—City Council. Accepted. Electrical repairs to council houses (£200).—R. H. Patterson.

Salford.—Electricity Committee. Accepted (annual contracts). Paper insulated cables.—Aberdare Cables; and Lancashire Cables.

Stockport.—Electricity Committee. Accepted. Water storage tank and radiators (£967).—Simon-Carves.

Sunderland.—Town Council. Accepted. Portable air compressor for electricity works (£545).—Broom & Wade.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ashton-under-Lyne.—Motor-bus station; A. L. Kemp, borough surveyor, Municipal Offices, Warrington Street.

Belper.—Houses (40) for U.D.C.; T. Fenn, Council Offices.

Bicester.—Recreation centre, Bennett's Close and Chapel Street, for Y.M.C.A.; local secretary.

Bristol.—Reconstruction of seamen's home (£6,000); Rev. H. J. C. Day, chaplain to Bristol Mission to Seamen.

Chatburn (Clitheroe).—Works canteen; Stonebridge Manufacturing Co., Ltd., Victoria Mills.

Chorlton-on-Medlock.—Factory alterations, Plymouth Grove; B. Pendleton, architect, 16, Brazennose Street, Albert Square, Manchester, 2.

Coventry.—Extensions of nurses' accommodation at Exhall Lodge Institution (£1,750); D. E. E. Gibson, city architect, 1a, Warwick Row.

Croydon.—Canteens at Lanfranc and South Norwood Schools (£2,406 with equipment); E. Taberner, Town Clerk.

Darlington.—Houses (30); W. J. Pallister, surveyor, Rural Council Offices.

Droitwich.—Houses at Hay Lane, Ombersley and Himbleton for R.D.C.; Pritchard, Godwin & Clist, architects, Bank Buildings, Kidderminster.

Durham.—Five clinics (£5,000); W. J. Merrett, county surveyor, Durham.

Essex.—A.R.P. premises (£21,000); county architect.

Gateshead.—Two nursery classes (£2,600); J. Clark & Son, builders, New Seaham.

Hylton (Co. Durham).—Miners' canteen; Jos. Huntley & Son, Marion Street, Sunderland.

Manchester.—Wartime day nursery, Openshaw (£2,950); J. A. Godfrey & Co., builders, 333, North Road, Manchester, 11.

Stores and garage; Agar's (1936), Ltd., caterers, 30, Wilbraham Road, Fallowfield, Manchester, 14.

Newcastle-on-Tyne.—Boilerhouse and additions to garage for Lees Bakeries, Ltd.

Sixty additional wardens' posts. Contractors (all of Newcastle):—G. G. Carr, Wilkinson Bros., R. W. Fullerton, West Monkseaton Building Co. Ltd., Elliott Bros., H. Waller, T. B. Hutchinson & Son, F. J. Hepple, T. H. Finlay, A. Gunning & Co., and S. F. Davidson.

Temporary school, Blakelaw estate; F. Harvey, Education Offices, Northumberland Road.

Northampton.—Public Assistance Institution; R. A. Winfield, borough surveyor, Guildhall.

North Riding.—Central kitchens at Thirsk and Richmond (3,800); county architect, County Hall, Northallerton.

Old Fletton.—Nursery (£3,000), rear of Council Offices; surveyor, Urban Council Offices, Old Fletton, Peterborough.

Pendleton.—Offices, Holland Street; R. A. Brand & Co., Ltd., paper manufacturers, Bridge Paper Mills, Holland Street.

Peterborough.—Buildings; B. & G. Transport. Dairy buildings; Horrell & Son, Westwood Farm.

Repton.—British Restaurant at Woodville; R.D.C. surveyor, The Poplars, Rolleston Road, Burton-on-Trent.

Stockport.—Fire station, Reddish Road, and alterations to Offices, Hempshaw Lane depot, for National Fire Service; W. F. Garner, borough surveyor, Town Hall.

Stone.—Houses, Milwich, Stanton and Cotes Heath for R.D.C.; Hollins & Jones, architects, Lloyds Bank Chambers, Newcastle, Staffs.

West Penwith.—British Restaurant at Hayle for R.D.C.; W. A. B. Battrick, clerk, 38, Chapel Street, Penzance.

Wigton.—Fire station at Silloth; R.D.C. surveyor.